Gas Journal, November 23, 1921. Registered as a Newspaper.

CHEMICAL LIBRARY DEC 8 1921

GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. CLVI. No. 3054.] LONDON, NOVEMBER 23, 1921. [73rd Year. Price 1s.

OXIDE OF IRON
SPENT OXIDE

GAS PURIFICATION AND CHEMICAL CO., Ltd.
PALMERSTON HOUSE, LONDON, E.C.2.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 London Wall.

Aluminium
RESISTS SULPHUR FUMES.
WRITE FOR GAS LEAFLET
THE BRITISH ALUMINIUM CO., LTD.
109, Queen Victoria Street, London.

R. & W. HAWTHORN LESLIE & CO., LTD.
In Stock.
TANK LOCOMOTIVES
Always in Progress.
Locomotive & Marine Engineers & Shipbuilders,
NEWCASTLE-ON-TYNE.

"TORBAY PAINT"
FOR ALL PURPOSES.
The TORBAY PAINT CO.,
26/28, Billiter St., LONDON, E.C.
39/41, Old Hall St., LIVERPOOL.

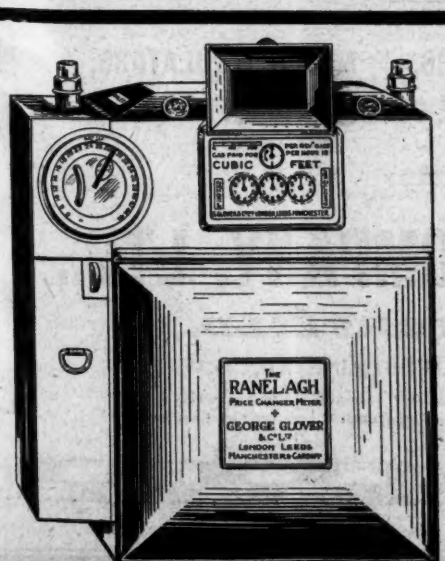
TROTTER, HAINES, & CORBETT, LIMITED.
BRETTELL'S ESTATE,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST FURNACE BRICKS, LUMPS, TILES, and every Description of FIRE BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
Shipments Promptly and Carefully Executed.
London Office: E. C. Brown & Co., Leadenhall Chambers, 4, St. Mary Axe, E.C.

INTERMITTENT VERTICALS.
Adopted all over the World.
Vertical Gas Retort Syndicate LTD.,
17, VICTORIA ST., WESTMINSTER, S.W.
Sole Agents for Australasia
JAMES HURLL & CO., LTD., SYDNEY.

JAMES McKELVIE & CO.
Coal Owners,
Gas and Steam Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
GUILDHALL CHAMBERS, SANDHILL, NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
ESTABLISHED 1846.

W. PARKINSON & CO.
(Incorporated in Parkinson and W. & B. Cowan, Ltd.),
LONDON & BIRMINGHAM.
(See Advertisement p. 544).

STEWARTS AND LLOYDS, LIMITED, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.



George Glover's New
"Ranelagh"
Price-changer Pre-payment Gas Meter.
The automatic valve of this meter **opens fully for the first coin,** even when set at as small a quantity as 5 feet per penny.
GEORGE GLOVER & Co., Ltd.
Ranelagh Works, Royal Avenue, Chelsea, London, S.W.3.
Branches: 9, Dewsbury Rd., Leeds, & Gaythorn Meter Works, Manchester.

J. & J. BRADDOCK

(Branch of Meters Limited),

GLOBE METER WORKS,

Telegrams: "Braddock, Oldham." Telephone 815.

OLDHAM,

AND

45 & 47, WESTMINSTER BRIDGE ROAD,

Telegrams: "Metriques, Lamb London." Telephone 2412 Hop.

LONDON, S.E. 1.

MANUFACTURERS OF HIGH-CLASS

GAS STATION METERS.

BRADDOCK'S

STATION GOVERNORS

AND

RETORT-HOUSE GOVERNORS.

IMPROVED

WET & DRY GAS METERS

OF BEST QUALITY.

BRADDOCK'S PATENT

"SLOT" METERS.

FULL PARTICULARS ON APPLICATION.

"LEAD WOOL"

Reg. Trade Mark.

PROVIDES BOTTLE-TIGHT JOINTS FOR HIGH OR LOW PRESSURE MAINS.

Is equally suitable for Steel or Cast-Iron Pipes. Its regular use will reduce unaccounted-for gas. The cost of the joint being less than with molten lead, capital expenditure is reduced.

Compressors Hired for Testing Mains. Competent Jointers sent out on reasonable terms.

When mainlaying is proposed, communicate with—

THE LEAD WOOL Co. (1919), Ltd.,

SNODLAND, KENT.

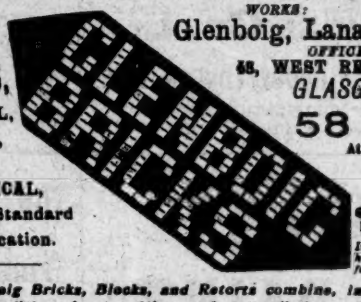
Telegrams: "Strength, Snodland." Telephone: Snodland 56.

THE GLENBOIG UNION FIRE-CLAY Co. Ltd.

WORKS: Glenboig, Lanarkshire.

OFFICES: 48, WEST REGENT ST., GLASGOW.

GAS-RETORTS, HORIZONTAL, INCLINED, and VERTICAL, to New Standard Specification.



58 FIRST AWARDS At International and Home Exhibitions, including Grand Prize at Brussels, 1910

In every case the highest award given for Fire Clay Goods.

The Glenboig Bricks, Blocks, and Retorts combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

B DONKIN D

DONKIN

for

DISTRICT SERVICE GOVERNORS

HIGH AND LOW PRESSURE SERVICE REGULATORS, METER REGULATORS, STOVE AND LAMP REGULATORS, SERVICE CLAMPS AND FITTINGS.

THE BRYAN DONKIN COMPANY, LTD.,

Head Offices & Works, CHESTERFIELD.

LONDON OFFICE: 3, VICTORIA STREET, WESTMINSTER, S.W. 1.

Chesterfield Telephone No. 84.
London Telephone No. 3358 Victoria.

Chesterfield Telegrams, "Donkin, Chesterfield."
London Telegrams, "Donkin, Vic. London."

B CHESTERFIELD D

GAS JOURNAL

LIGHT ✻ HEAT ✻ POWER ✻ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CLVI., No. 3054.] WEDNESDAY, NOVEMBER 23, 1921. [73RD YEAR.

EDITORIAL NOTES.

The Compass of the Gas Regulation Act.

As Orders under the Gas Regulation Act are introduced, and a beginning is made with operations under them, responsible gas officials will take opportunities at Gas Association meetings to compare notes as to experiences. The Act really opens up a large amount of virgin soil, which will give the industry's technical and commercial organizations much topic for discussion for some time to come. Mr. W. E. Caton, of Oxford, at last Thursday's meeting of the Midland Association of Gas Engineers and Managers, presented a paper on the subject of the Act. The author has been through the mill, if we may so call a comparatively comfortable journey. His Company applied for an Order under section 1 of the Act, obtained it, and have been working on the heat-unit basis for a quarter. Therefore, he knows what has to be done to secure an Order; and he can speak with some experience as to the introduction of the new system, and say what in his view are the methods that should be applied. This he does in the present paper, which will therefore be of interest to those who have not yet applied for an Order; and, with his notes as to what he has done in introducing the authorization of the Order into his Company's commercial system, there will be some comparison by those who have got as far along the new road as he has gone.

Those who have yet to obtain an Order under section 1 will be encouraged to learn that application is not such a formidable task as appears on first looking at the schedule which the Board of Trade require to be filled up. As a matter of fact, the policy that has in this matter been pursued from the outset by the Director of Gas Administration and his department has been to be helpful as well as judicial. Applicants generally have found that reasonableness prevails; and if it is impossible to carry out dissection of the accounts to the very letter of the printed requirement—well, then, it has been a question of arriving at the finest approximation that conditions and available particulars will permit. The principles adopted by the Board in determining the standard or maximum therm price are described in the paper; but the application of the principles that are common to all are not so important as the preliminary investigation that is needed to ascertain that the data furnished to support the claim for a certain standard or maximum price are sound in all respects. That is what takes up time between the application for, and the granting of, an Order; and as far as possible, in view of the multiplicity of applications, treatment has to be in the order of application. For the Director of Gas Administration to find that a gas undertaking has attempted by the supplied data to secure a higher standard or maximum price than it is entitled to under the Act is not a pleasant thing; but we believe that, judging from the prices allowed compared with the prices claimed, there has been very little attempt at excess.

The Act appears to be looked upon variously by the men of the industry as a means of assisting them to redress the financial hardships of their undertakings, as a means of conferring more liberty in regard to gas production, and, under section 10, as a means of obtaining additional powers at a minimum of expense. The Act, of course, is all that and more, as Mr. Caton recognizes. It is, properly and comprehensively regarded, a constructive measure. When considered as a constructive measure, it will be seen why various things in it have been enacted, and how the different parts are interrelated. When all gas undertakings are brought under the Act, gas engineers will then universally have a definite object for which to work. Before, they had not a common definite object. Some of them used to work with the sole view of big makes per ton, never caring much as to the composition or quality of the makes. There was nothing intrinsically comparable in this. Now they have a common object, and that is to work for the making of the largest amount of therms per ton of coal consistent with ultimate over-all economy and financial result, as tested by the two factors of profits made and price charged per therm. They will not be paid for inerts now; and they will speak with more or less pride of the number of therms produced and sold per ton, and of the price charged per therm—the last-named being the most important figure, when considered in relation to the general financial stability of the concern. That is the constructive object of the Act; and though we may be perplexed as to the correct calorific power to declare at the outset, and may say and think all manner of things about a minimum 2 in. pressure at all times and in all places, the liberty as to calorific declarations is necessary to the progress of coal carbonization or gasification and so of the industry, and a higher minimum pressure and betterment where necessary of distribution systems are essential auxiliaries to the advance in therm production, which will generally mean lower concentrations of heat units. In these respects, time will show that the Act is well and safely constructed.

"What calorific power shall I declare?" is a question that, as Mr. Caton says, will be uppermost in a gas manager's mind after obtaining an Order. The difficulties of knowing what is best to be done in the immediate circumstances of existing plant and other conditions are many, combined with the necessity of supplying the declared calorific value to every consumer at the uttermost parts of the area, and the knowledge of public odium and dissatisfaction if forfeitures have to be inflicted or adjustments have to be made in prices to the consumers for an average deficiency in a preceding quarter. Gas undertakings must proceed by the process of experience, and through the opportunities afforded by plant conversion or new introductions to increase the thermal value of production in the form of gas. The author rightly adopts the line of prudence—perhaps, if he errs at all, it is on the side of too great prudence. "My advice," he says, "to those in doubt is to carry on, and declare (say) "10 B.Th.U. per cubic foot lower than that you are now "supplying, unless, of course, new plant has been installed "to enable you to make gas of a different quality." Whether 10 B.Th.U. is a sufficient start depends on the calorific quality of the gas now being supplied. The figure named is only a 2 p.ct. reduction on a 500 B.Th.U. gas; a 10 p.ct. reduction might well be made on a higher quality of gas—say, 520 or 530 B.Th.U. gas—if economy favoured. The Act looks forward. It legislates for progress and for changed circumstances. Whatever declaration is tentatively made at the outset, the measure adequately provides for revision as conditions enable or command in the name of economy.

Well, Mr. Caton considers that on the whole the Act is quite good, "when it is remembered that it is more or less "the result of a compromise in order to obtain financial "relief, as it provides for the restoring of the stability of "the industry, and will allow of development in the manu- "facture of gas which, without it, would have been impos- "sible." We do not think there is much "compromise" about the Act. Its real origin had nothing to do with finance. Its first stage is found in the report of the Board of Fuel Research on "Gas Standards;" and in this report there are the recommendations that form the main parts of

the Act. The fundamental idea was the development of the thermal side of the industry with charges to consumers on the heat-unit basis. The revision of standard and maximum prices was conveniently inserted into the measure designed to carry-out the constructive proposals of the Board of Fuel Research. However, that is a small matter; but it is better to maintain in view the exact genesis of the measure, because that is helpful in keeping alive our appreciation of its constructive intentions. Mr. Caton fully approves of the gas business being done on the heat-unit basis; but like ourselves he knows some gas men who would prefer to continue trading on the cubic feet basis, if they could get financial revision. No doubt. There are many people who cannot shake-off the shackles of tradition; and there are some gas managers who would be well content to continue jogging along under an illuminating power standard. We can ignore them. They or their successors will be brought into line, just as (under the Act) the well-protected consumers will find the therm of greater interest to them than the cubic foot. Mr. Caton is of opinion that it will be some time before the consumers thoroughly understand the therm. The bulk of the consumers little understood what a cubic foot of gas was, much less 1000 c.ft. The consumers are becoming interested in therms, because of the novelty. Several have personally asked us: "What is a therm?" Before explaining we have inquired: "Do you know what a cubic foot of gas "is?" And positively well-educated people are found who cannot define a cubic foot. The most should be made of the fact that interest is growing. The consumers should be made to understand that they are buying heat quality and not quantity of gas. "If undertakings," writes Mr. Caton, "when they commence to sell by heat units, will lay themselves out to assist the consumers in understanding the "change, they will materially shorten the period of confu"sion." There has not been much "confusion" in London; and if gas undertakings will only set themselves by well-organized publicity and explanation to make the change well known and plain, if "confusion" or any other term is the appropriate one, it will soon vanish. And we are perfectly in agreement with the author that, from the point of view of those responsible for satisfying the consumer, and persuading him to maintain and increase the consumption of gas, the advantages of the Act more than outweigh the disadvantages. What these disadvantages are, do not appear to be of an alarming character. But that can pass. The author's views as to what should be shown on meter cards and accounts will meet with considerable approval, though it must be expected that at the initial stages the meter readers will take somewhat more time over their work. But in this as in other things, there will be a speeding-up with practice. As we go along, the difficulties, imagined or otherwise, will disappear, and matters will run along as smoothly as though they had always been. The paper by Mr. Caton is a good and practical one.

The Conversion of Scotland.

There was a time when practically all the rest of the gas undertakings of the United Kingdom were bringing down the standard illuminating power of their gas to 14 candles, that some gas administrators in Scotland stuck tenaciously to their 18 and up to even 22 candle gas, with all its incomplete combustion and carbon emission. But during the war and since, we have seen a complete metamorphosis. Several managers in Scotland are now leading the way in a high make per ton of (as we now regard it) the lower calorific grades of town gas, but yielding a good therm value per ton and per retort. Economy has put high luminosity of gas *per se* in its place as something obsolete. We have seen this before in papers submitted to the Scottish gas organizations; we see it again this week in the proceedings at meetings of the two Scottish Junior Associations—the Western and Eastern Districts. At the former, Mr. Peter Sim, of Buckie, gave a most interesting account of working at the Johnstone Gas-Works with American coal, together with experimental results. The retorts used were the Glasgow continuous-intermittents. The coal was subjected to twelve-hour carbonization and steaming, and the gas ranged from 350 to 360 B.Th.U. One week's test shows 26,223 c.ft. of 350·14 B.Th.U. gas per ton of coal, or 91·81 therms. Mr. Sim says that generally with a readjustment carried out throughout the district in gas-cooker burners, and a reduction in the air-pull of gas-engines, very satisfactory results were obtained at a calorific value varying from 350 to 360 B.Th.U. per cubic foot. At the meeting at Cupar of the Eastern District Section of the Association, Mr. J. M'Pherson, the Engineer and Manager of the Company, told his visitors that, with his Woodall-Duckham retorts, he makes about 19,500 c.ft. of 425 B.Th.U. gas per ton of coal, which is equal to 82·87 therms. This and prior information (not forgetting the pioneer and far-reaching work of Uddingston) show the definite trend in Scotland of gas production of the lower calorific grades. But returning to Mr. Sim's paper (it is the only one we have had containing complete tests of American coal under British carbonizing conditions), he reflects progressive Scottish opinion to-day when he says: "I think I am safe in saying that, with the necessary "initial pressure at hand, very few will willingly resort to "the old-time calorific value of 500 to 600 B.Th.U., especi"ally now that the foreword in all forms of industry is "economy." Fancy being able now to talk of 500 to 600 B.Th.U. as "old-time"! And before the Gas Regulation Act, Parliament, with its want of wisdom on these matters, would not look at any standard (save in rare cases) below 500 B.Th.U. In fact, the policy was to attempt to standardize 500 B.Th.U., for all works despite variations of condition. The Board of Fuel Research were competent to take a broader outlook than Parliamentary Committees.

Verticals and Steaming: Coal Size and Maintenance.

With changes in conditions and advancement in processes, views and practices have to be altered; and there has to be a large abandonment of the formulæ of the old text-books. At one time capital costs almost got standardized for units of carbonizing plant; and some engineers have found it a really difficult job to get embedded in their minds the fact that the spending of additional capital per unit of higher efficiency plant may mean a very definite economy, from the points of view of increased make, lower fuel accounts, reduced labour per unit of output, and lower maintenance costs—these in part or all combined. Also that with the higher efficiency plant, greater supervision may be required over the details of operation in order uninterruptedly to bring into account the gains that are possible. Yet with all this, the ultimate money benefit pays. This has been seen frequently of late in the papers that have been presented to the various Associations on continuous vertical retort operation with steaming. It is seen again in the paper that Mr. E. Gillett, of Bradford, read before the Yorkshire Junior Association last week. The contribution does not deal with all the points made in the opening lines above. It treats more of supervision and methods to secure high results in working—a matter to which close attention is being given to-day in all well-conducted works having such plant—as well as a testimonial from long-time experience regarding maintenance.

The question of coal is one of the prominent matters dealt with. The polemical point as to whether coal of certain physical and chemical characteristics can or cannot be dealt with in continuous vertical retorts—coal such as that from Durham—has to a large extent been settled by experiment and experience, which show that successful working is very much a question of the regulation of temperature to throughput. But the point raised by Mr. Gillett is as to the influence of size of coal on good steaming results. This is a matter that has been discussed before. He finds that when coal is tipped into the coal bunkers, the small and the nuts get concentrated at the centre, and the large coal rolls away to the sides. Consequently, some retorts get charged with the small and others with the rough coal; and over-all better results—more particularly steaming results—are obtained in the former than in the latter case. Much the same opinions have been expressed before, and what Mr. Gillett says corroborates them. With the more compact charge, it is held that there is better time contact between the steam, coke, and carbon to produce good water-gas results. With the rougher coal, it is found by the author that steam gets away before it becomes fully decomposed. The question wants thorough investigation in relation to temperature, because with the dense charge of small coal, heat transmission is slower than with the more open charge. So while the denser charge may act as a check to the steam, the more rapid passage of heat in the case of the more open charge may have some compensatory effect. Moreover, it would be interesting to know whether the temperatures employed are the same with the rougher and the finer charges

with steaming. These points are only raised suggestively, and not assertively.

As to maintenance, Mr. Gillett positively says that "wear "and tear on vertical retorts is less than on horizontals, and "maintenance costs are not excessive." After nine years' working with verticals, he finds the latest repairs show only a small increase in cost—making due allowance for the extra prices of materials, labour, &c. Steaming has affected the retorts very little. If there is any bad effect on the retorts with the use of steam, it is very well balanced by the saving in scurfing. Scurfing does more damage to the retorts than twelve months' steaming. Sir George Beilby tells us that at the Fuel Research Station, they cannot afford to run their continuous vertical retorts without steaming; so that steaming actually adds to its economic virtues by minimizing maintenance, through helping to protect the lower parts of the retorts and metal work from the injurious influences of high temperature there, and through limiting the ravages of scurfing.

Population and Gas and Electricity Consumers.

As we have recently noted [*ante*, p. 431], the Electric Lamp Manufacturers' Association are making a powerful publicity effort to promote the demand for electric lamps, which, if successful, will be a benefit to the electricity industry generally. In other words, they have deliberately set themselves to take from gas and give to electricity; and no one can dispute their right as commercial men to do all they can in this direction. But also as commercial men, those responsible for the trading interests of the gas industry will set themselves to see that the minimum success attends the endeavour. By the kindness of the Association, we have received a booklet which they have issued to stimulate interest in their business-creating effort. At the end of the booklet, there is a map, which gives the population of each county in England, and the totals for Wales, Scotland, and Ireland, together with the numbers of gas and electricity consumers in these various quarters. The map shows how lean in the aggregate is the proportion of electricity consumers to the total population; and how relatively fat is the proportion of gas consumers. This is the point that the authors wish to emphasize, in order to energize into greater activity the electricity supply industry. From the map we have compiled the table that appears on p. 549 of this issue. For gas the figures do not exactly square with those in the last-issued Board of Trade returns relating to statutory gas undertakings; the total of the figures being below the total in the returns, which, moreover, do not include the customers of non-statutory concerns. Therefore, assuming the correctness of the figures for electricity, the difference between gas and electricity, on the basis of consumers, is actually worse than the map indicates. Certain it is, too, that the county areas are not coterminous with the supply areas of the gas undertakings the customers of which are included in the counties. Therefore, regarded from the county point of view, the figures on the map and our in table as to consumers are defective, as well as out of harmony with those in the official returns.

If, however, we accept the figures as being approximately correct, they are very interesting. The total population for the United Kingdom is given as 47,084,633; the number of gas consumers, as 6,914,946; and the number of electricity consumers, as 933,778. The figure for gas consumers in the Board of Trade returns (for the year 1919 in the case of companies, and for the year ending March, 1920, in the case of local authorities) is 7,540,133, or more by 625,187 than the Association's publication shows. But even the higher figure in the returns is not the total, inasmuch as it does not include a single non-statutory concern. We have not checked all the figures for gas, as obviously according to the total they fall very short of completeness. A particularly glaring error is Wiltshire, the population of which is given as 292,213, the gas consumers as 214,082, and the electric consumers as 2047, which means that 74 p.ct. of the men, women, and children of Wiltshire are registered on the books of the gas and electricity suppliers as consumers! We suggest that the number of the customers of statutory gas undertakings in the county would be better represented by the figures 27,897, without those of the non-statutory undertakings.

Taking the figures as they are quoted on the map, it will be seen that gas is credited with having 5,981,168 more consumers than electricity; and, as a matter of fact, if the electricity figure of 933,778 is accurate, then, according to the Board of Trade returns, the statutory gas undertakings of the country have 6,606,355 more consumers than electricity, without reckoning the non-statutory ones. Calculating on the figures in the table, the gas consumers represent 14·6 p.ct. of the population; and the electricity consumers slightly less than 2 p.ct. If the assumption were acceptable that an average of six to seven persons will represent a household, then a close approach to universal use could be claimed for gas. But, of course, there are several other factors that come into consideration, such as industrial and shop custom, which all represent "consumers." We think there will be a considerable amount of interest taken in the table, quite apart from the purpose which gave birth to the map. For instance, some of the counties have a much greater proportion of consumers to population than others. This may be due to many factors—density and characteristics of population, the nature of local industries, and perhaps the degree of energy displayed by the local gas undertakings in extending the arms of their distribution systems and the magnitude of their businesses. This is a point which should be carefully investigated, to ascertain the reason for low proportions of consumers relative to the population. Take Buckinghamshire, for example—the population is 236,209; but there are only 8254 gas consumers, according to the table. The Board of Trade returns show 15,714 consumers for statutory gas companies alone! Cornwall is a worse example; for with a population of 320,559, the gas consumers, it is stated, only number 8308, which is about correct. Dorsetshire, too, with a population of 228,258, is only credited with 5027 gas consumers. Actually it has double that number on the mains of statutory gas concerns. But Bedfordshire, with a population of 206,478, boasts of 22,948 gas consumers (29,000 would be nearer the mark. Gloucestershire, too, with a population of 757,668, has 33,767 gas consumers, which (if true) would be little better than Berkshire in respect of gas consumers, seeing that it claims 32,693 (which is about 600 short), with a population of 294,807. But the figure for Gloucestershire is not true, as it seems to have missed the 71,000 or so of Bristol gas consumers. However, enough has been said to show how widely the figures as to consumers diverge in relation to county population.

London is the most developed gas area in the country. With a population of 4,483,249, it is credited with 1,637,694 gas consumers, or 36·5 p.ct. of the population. Evidently the South Suburban and Wandsworth Companies' returns are included in those of the three Metropolitan Gas Companies. It would be difficult to ascertain the population within the areas of the five Companies, so that the number of gas consumers worked-out at a percentage of the population cannot be regarded as quite correct. In other words, the population area is not coterminous with the areas of the five companies. The South Suburban district runs deep into Kent, and the Wandsworth Company's area embraces Wimbledon and away to Epsom. Turning to Lancashire, the county has a population of 4,928,359; and the attributed number of gas consumers is 1,049,352, or 21·3 p.ct. of the population. Yorkshire has a population of 4,182,735; and the consumers according to the table number 635,770, or 15·2 p.ct. of the population. Warwickshire, with its population of 1,390,092, has 244,839 consumers, or 17·6 p.ct. We have not checked this last group of whole figures. But speaking of the figures generally, there is a large amount of interest to be extracted from them, though a thorough comparison with the Board of Trade returns and the inclusion of the numbers of consumers of non-statutory companies might more or less alter them. This is seen by the fact that the total number of gas consumers in the table falls short by no less than 625,187 of the total in the Board of Trade returns relating only to statutory undertakings.

Coal Advisory Committee.

The Committee which the Secretary of Mines (the Right Hon. W. C. Bridgeman) has appointed, under section 4 of the Mining Industry Act, to assist him in an advisory capacity is a good one. Welcome is given to Sir Andrew R. Duncan, who is to be the Chairman. As Coal Controller during a most critical period, Sir Andrew won golden regard from those who were brought into immediate contact with him. And the gas industry had good cause for thanking him. In the general membership, all interests are represented—owners, workers, and users. Among

the representatives of employers and industries is the President of the National Gas Council (Mr. D. Milne Watson). Representing science are Sir George Beilby, F.R.S., Sir John Cadman, and Dr. J. S. Haldane, F.R.S., who is one of the Gas Referees. The interests of the gas industry should be well safe-guarded.

Last Week's Congress.

The first of the series of conferences in connection with the Public Works, Roads, and Transport Congress was held last Friday. The arrangements for the day were in the hands of the Institution of Gas Engineers; and the President (Mr. Thomas Hardie) was in the chair. The subjects discussed ranged over public lighting, benzole for transport purposes, coal tar for road work, and the reduction of atmospheric pollution resulting from the use of gaseous fuel—matters all particularly germane to the amenities and conveniences of outdoor life and communal service. Part of the proceedings is reported in this week's issue; and we will defer a few comments to our next issue, when it is hoped to conclude the report.

Labour and Gas Supply.

Gas supply offers a larger field of employment to labour than electricity; but certain labour candidates in municipal elections have been advocating a policy of replacing gas by electricity. In other words, by suggesting the curtailment of the business open to the gas industry, they are, in effect, proposing the support of an industry largely mechanically operated at the generating end, as against an industry giving considerable employment at its manufacturing end. Some of our would-be local governors have singular notions as to how best to serve the public generally, and particularly the interests of their own ranks in respect of work. Gas workers should watch these labour advocates of gas displacement very narrowly, and indicate to them their views as to this advocacy of taking business from the industry in which they are employed.

Coal Cost and Transport.

The Mining Association have been discussing with the railway managers the question of a reduction in the rates for the transport of coal; and they seem to entertain a good deal of hopefulness that a concession will be made. A strong case was put forward by the Mining Association; and naturally in industrial circles, the decision is awaited with some amount of eagerness. The relief sought in transport is one of the ways in which the coal-owners are looking for a cheapening of the cost of coal to the consumers. The export trade is improving as a result of the lowering of prices; and the coalowners realize that price reduction is the only way to re-establish the coal trade on a firmer basis. It is a pity the miners do not see this, and make a contribution by an increased production per man and per unit of wages cost.

The Munitions Bonus.

An estimate by the Amalgamated Engineering Union places at £50,000,000 the reduction in annual wages cost by the acceptance by the members of the engineering and shipbuilding unions of the scheme for withdrawing by instalments the 12½ and 7½ p.ct. bonus. It is hoped that this will result in a revival of trade, and assist in finding employment for the 87,768 unemployed members of the Amalgamated Engineering Union—which number represents a percentage to membership of 24·9.

Sulphate Exports.

The export trade in sulphate of ammonia is being pulled up How long this will continue must be left to developments in production—from both the nitrogen of the atmosphere and that of coal. In the ten months to October, the tonnage shipped was 108,707, compared with 86,427 tons in the ten months ending October, 1920.

Gas Coke Shipments.

These are being maintained. During October 56,852 tons were dispatched, as against 43,808 tons in October last year. But there was a remarkable difference in price. The value of the 56,852 tons last month was £89,008; while in October last year the value of the 43,808 tons was £311,257—averaging respectively £1 11s. 3·7d. and £7 2s. 1·2d. In the ten months 327,797 tons have been shipped; the value being £733,371. In the corresponding period of 1920, 676,034 tons were exported, with a value attached of £4,171,191—the average per ton being respectively £2 4s. 9d. and £6 3s. 4d.

Gas Coal Exports.

Gas coal exports are creeping-up. Out of a total of 3,405,972 tons of coal shipped last month, 472,082 are classified as gas coal, of a value of £708,125, compared with 164,119 tons in October, 1920, of a value of £645,631. But last month's exports of gas coal are not half what they amounted to in 1913, when 1,026,497 tons so described were shipped. But the million odd tons only had £653,604 ascribed as its value—less than the value of the 472,082 tons exported last month. The "gas coal" figures for the ten months are: 2,611,065 tons; for the corresponding period of 1920, 1,751,241 tons; and for the like period of 1913, 9,610,209 tons.

Gas Oil Imports.

In October 5,269,963 gallons of gas oil were delivered into this country, compared with 3,960,017 gallons in October last year. In the past ten months, 60,978,594 gallons were imported, as against 47,250,349 gallons in the corresponding period of 1920. This reflects the increased use and demand for gas-making.

Gas Coal Position.

While the export trade is somewhat better, but enormously below what it would have been had there been no break in its continuity, and while industrial demand shows a slightly improved tendency, the reports from the various coal areas are unanimous in indicating that there is a greater requirement for coal from the gas industry through the increased demand for gas, owing to the colder weather and the longer lighting hours. This, however, is not the only reason for the improved demand. The anticipations that this winter will prove to be a hard one, with unfavourable climatic conditions for transport, are inducing responsible gas officials to see that they are well covered in respect of stocks. This report as to increased coal sales for gas-making applies to most of the coal areas; and Yorkshire especially seems to be enjoying more activity in regard to the renewal of gas-coal contracts. The large available supplies in those districts whence the bulk of the export business is normally done, are bringing about regional competition for the custom of large consumers, and this has had an effect in a lowering of offers by, in some cases, 3s. to 4s. per ton. The feature noted last week of gas undertakings purchasing the best qualities of coal continued during last week—large screened sorts being particularly in demand.

Benzole Research.

The Joint Benzole Research Committee of the University of Leeds and the National Benzole Association has commenced its work by the choice of a Research Chemist, who was officially appointed by the Council of the University at its meeting on Wednesday last. Mr. E. C. Williams, M.Sc., who has received the appointment, graduated in 1914 at the University of Manchester, at the head of the first-class honours list in the School of Chemistry. He was awarded the Mercer and Dalton Research Scholarships for research theses, and a special University prize for physical chemistry. His M.Sc. was gained by research. After two years' service in the army, where he attained the rank of captain, Mr. Williams was appointed Research Chemist to British Dyes, Ltd.; and during the past four-and-a-half years he has been engaged not only upon laboratory research, but on large-scale work and administration—as head of the department at the Dalton works, Huddersfield, for the manufacture of intermediate products. Mr. Williams's work will centre at the University of Leeds in the Department of Coal Gas and Fuel Industries, where laboratory facilities are provided; but it will also be carried out as far as may be found desirable on the plants engaged in benzole production and the laboratories attached thereto.

Annual Meeting of the National Gas Council.—Readers are reminded that the annual general meeting of the National Gas Council has been fixed to take place in the Aeolian Hall, Nos. 151-137, New Bond Street, at 3 p.m., on Wednesday, Dec. 14.

Recovery of Benzole.—Considerable attention is, says the "Engineer," being paid in Germany to the process devised by the late Dr. Runkel, Chemist to the Bayer Company, for the recovery of benzole from gas by absorption by wood charcoal. The process has been long known in France, and has been tried in the United States, where, since 1911, experimenters have endeavoured to recover petrol from natural gas by these means. But it has not led to much, though the problem is in that case a relatively simple one. In 1916, the French Ministry of Munitions tried charcoal in order to recover ether-alcohol in explosive works; but it was found to be troublesome and expensive.

COAL ADVISORY COMMITTEE.

THE Secretary for Mines announces that, in accordance with the provisions of section 4 of the Mining Industry Act, 1920, he has appointed the following gentlemen to serve on the Advisory Committee for Coal and the Coal Industry:

Sir ANDREW R. DUNCAN, Chairman.

Mr. WILLIAM HUMBLE, Mr. MONTAGUE FRANCIS MACLEAN, J.P., Sir ADAM NIMMO, K.B.E., and Mr. EVAN WILLIAMS, representatives of owners of coal mines.

Mr. FRANK HODGES, J.P., Mr. W. P. RICHARDSON, Mr. HERBERT SMITH, and Mr. STEPHEN WALSH, M.P., representatives of workers in or about coal mines.

Sir OWEN COSBY PHILIPPS, G.C.M.G., M.P., Mr. BENJAMIN TALBOT, J.P., and Mr. D. MILNE WATSON, representatives of employers in other industries.

Mr. J. W. OGDEN, J.P., Mr. BEN TILLETT, M.P., and Mr. A. G. WALKDEN, representatives of workers in other industries.

Colonel W. C. BLACKETT, C.B.E., J.P., representing mining engineers.

Captain PERCIVAL MUSCHAMP and Mr. F. M'AVOY, representatives of agents or managers or under-managers of coal mines holding first-class certificates.

Mr. E. FRANKLIN THOMAS, representing coal exporters.

Mr. H. CECIL RICKETT, O.B.E., representing coal factors and merchants.

Sir EDWIN FORSYTH STOCKTON, representing those sections of commerce engaged otherwise than in the production or distribution of coal.

Mr. A. E. COCKBAINE, representing co-operative traders.

Sir GEORGE T. BEILBY, F.R.S., Sir JOHN CADMAN, K.C.M.G., and Dr. JOHN SCOTT HALDANE, F.R.S., representing the medical or other sciences.

Mr. F. C. STARLING, of the Mines Department, will act as Secretary to the Committee.

Arrangements are being made to hold the first meeting of the Committee at an early date.

NATIONAL GAS COUNCIL.

District Executive Board for Yorkshire (West Riding).

The Annual Meeting of the above Board was held at the Bradford Corporation Gas Department Showrooms, on Thursday, the 20th ult.

The annual report of the Management Committee showed an increase of seven undertakings during the year. The principal item in the report was with reference to the purchase of imported coal during the coal stoppage. Nine cargoes of French, American, Canadian, &c., coal amounting to 26,000 tons had been purchased on a co-operative basis, in which 44 undertakings participated. The saving compared with the prices demanded from other sources of supply for imported coal amounted to a very considerable sum.

The officers elected for the ensuing year were as follows:

Chairman: Mr. Charles Wood (Bradford).

Vice-Chairman: Mr. H. Townsend (Wakefield).

Management Committee: Mr. Wood, Mr. Townsend, Mr. R. Watson (Doncaster), Mr. W. B. M'Lusky (Halifax), Mr. A. Bromley (Keighley), Mr. C. S. Shapley (Leeds), Mr. A. E. Mottram (Ossett), Mr. H. Singleton (Huddersfield), Mr. F. H. Robinson (Harrogate), Mr. G. Lupton (Otley), Mr. J. W. Turner (Mirfield), Mr. E. H. Hudson (Normanton), Mr. R. Halkett (Sheffield), Mr. H. E. Bloor (York).

Secretary: Mr. F. D. Richmond (late of Heckmondwike) agreed to continue as Secretary until the appointment of a successor could be arranged.

The retiring Member of the Central Executive Board, Mr. A. E. Mottram (Ossett), was re-elected.

Mr. E. J. Fottrell and Mr. S. S. Ogilvie addressed the meeting on matters engaging the attention of the Council.

INSTITUTION OF GAS ENGINEERS.

Candidates.

AT a Meeting of the Membership Committee of the Institution of Gas Engineers, held in Birmingham on Friday, Nov. 11, the following were approved as candidates:

For the Class of Member.

J. Beardsmore-Hyde, Engineer, Manager, and Secretary, Gas-Works, Hawkhurst.

T. H. Beaumont, Engineer and Manager, Gas-Works, Horley.

Herbert Duxbury, Engineer and Manager, Gas Department, Llandudno.

C. L. Goodwin, Engineer and Manager, Gas-Works, Woodbridge.

C. R. Longbotham, Engineer and Manager, Gas-Works, St. Albans.

Urban O. S. Nairne, Works Manager and Chief Chemist, Wandsworth, Wimbledon, and Epsom District Gas Company.

Robert Needham, Manager and Secretary, Gas-Works, Ramsay, I. of M.

H. T. W. Pilbeam, Gas Engineer, City of Santos Improvements Company, Santos, Brazil.

Frank Porteous, Engineer and Manager, Gas-Works, Ware, Herts.

A. R. W. Roberts, Engineer and Manager, Gas-Works, Hereford.

F. C. Robinson, Assistant Engineer, British Gas Light Company, Hull.

Melville Russell, Engineer and Manager, Gas-Works, Elstree.

W. H. Wise, Engineer and Manager, Gas-Works, Droitwich.

For the Class of Associate Member.

C. J. Dickenson Gair, Works Chemist, South Metropolitan Gas-Works, Vauxhall.

A. H. Hayter, Assistant Chemist, Gas-Works, Hornsey, N.

J. D. Hester, Assistant Manager, Ventnor Gas and Water Company.

D. T. Livesey, Assistant Engineer, Gas-Works, Stretford, near Manchester.

Percy Parrish, Manager, Chemical Works, South Metropolitan Gas Company.

Arthur Wells, Engineer and Manager, Gas Department, Milton Regis, Kent.

Transference.

T. S. Godwin, Manager and Resident Engineer, Gas-Works, Watford, was recommended for transference from the class of associate member to that of member.

Studentship.

The following were recommended for admission as students of the Institution:

J. A. Rose, Laboratory Assistant, Wapping Gas-Works.

W. H. Watkins, Showroom Assistant, South Suburban Gas Company.

The next meeting of the Membership Committee will be held on Monday, Dec. 12.

THE RELATION OF GAS AND ELECTRICITY CONSUMERS TO POPULATION.

THE Electric Lamp Manufacturers' Association have started a new campaign to stimulate the electric lamp business. Among their literature is a booklet entitled "Creating Business for the Lamp Season;" and at the end of the booklet there is a map, which divides England into counties, and gives statistics as to population and gas and electricity consumers. The totals for Wales, Scotland, and Ireland are also supplied. The figures for gas are not correct, as is easily demonstrated by reference to the Board of Trade returns relating to statutory gas undertakings. But we have compiled from the map the following table; and give the figures as (shall we say?) an approximate basis for comparison. Striking is the smallness of the number of electricity consumers in comparison with the deficient number given as representing the gas consumers. However, we need not further refer to the compilation, as in our editorial columns comment is made upon some of the figures. The table is as follows:

	Population.	Gas.	Electric.
Bedfordshire	206,478	22,918	4,512
Berkshire	294,807	32,693	4,028
Buckinghamshire	236,209	8,254	2,712
Cambridgeshire	203,372	17,219	2,145
Cheshire	1,025,423	139,915	22,469
Cornwall	320,559	8,308	3,279
Cumberland	273,037	17,839	2,661
Derbyshire	714,539	54,506	9,319
Devonshire	709,488	103,788	11,910
Dorsetshire	228,258	5,027	1,429
Durham	1,478,506	204,402	14,959
Essex	1,468,341	65,411	18,906
Gloucestershire	757,668	33,767	4,618
Hampshire and Isle of Wight	1,005,030	153,406	29,973
Herefordshire	113,118	7,530	1,709
Hertfordshire	333,236	17,182	4,009
Kent	1,141,867	133,380	24,653
Lancashire	4,928,359	1,049,352	97,476
Leicestershire	494,522	72,486	9,523
Lincolnshire	602,105	35,537	5,127
London	4,483,249	1,637,691	214,555
Middlesex	1,253,164	87,046	26,170
Monmouthshire	450,700	30,484	5,440
Norfolk	504,277	42,273	12,334
Northamptonshire	349,384	58,541	7,502
Northumberland	746,138	179,572	18,641
Nottinghamshire	641,134	88,423	7,080
Oxfordshire	189,558	17,060	3,640
Salop	242,959	12,235	2,250
Somersetshire	465,682	35,074	6,349
Staffordshire	1,319,225	100,824	17,921
Suffolk	399,988	37,494	9,384
Surrey	930,377	138,504	41,435
Sussex	728,001	107,606	25,522
Wales	2,206,712	186,024	29,279
Warwickshire	1,390,092	244,839	24,297
Westmoreland	65,740	5,015	992
Wiltshire	292,213	214,082	2,047
Worcestershire	405,876	34,931	4,097
Yorkshire	4,182,735	635,770	79,130
Scotland	4,882,288	750,431	96,859
Ireland	4,390,219	88,074	23,438
	47,084,633	6,914,946	933,778

PERSONAL.

Mr. ALEXANDER M. KEILLOR, at present Manager of Kincardine-on-Forth Gas-Works, has been appointed Manager of the Tillicoultry Gas Company. Mr. Keillor is a member of the well-known family of gas managers of that name in Scotland, and was selected from a list of 87 applicants.

OBITUARY.

ALBERT ELLISSEN.

WE have to announce, with deep regret, the death on the 1st inst., of M. Albert Ellissen, Past-President of the Société Technique de l'Industrie du Gaz en France, and Administrateur de la Société du "Journal des Usines à Gaz." The last issue of that paper contained an obituary notice and appreciation by M. Laurain; and we cannot do better than publish a translation.

"Albert Ellissen, whose personality was well known to all gas men, died on Nov. 1, aged 83 years. At his funeral, a masterly address was delivered, on behalf of the Société Technique, by M. Francis Rouland, a Past-President, who recalled the eminent services rendered by Albert Ellissen to the gas industry. With him passed the last of the founders of the Société Technique, of which he was President in 1881 and 1888. An engineer of high worth, a clear-sighted business man, and one endowed with a remarkable capacity for work, Albert Ellissen rightly occupied the most exalted positions—not only in our industry, in which his word was paramount, but in every enterprise on which he brought to bear the weight of his activity and competence. A member of many Boards of Directors, he proved himself everywhere a councillor of unusual intelligence, always ready to enlighten those who sought the help of his wide experience of men and affairs.

"Appointed Chevalier of the Légion d'Honneur in 1871 for his services in organizing the Croix Rouge and for his devotion on the field of battle near Paris in 1870, he was promoted to Officier of the Légion in July, 1888. In 1911, the Société Technique, wishing to honour M. Ellissen by some token of particular esteem, invested him for his long and meritorious service to our industry with the medal reserved for our more modest workers.

"It is with emotion that we bow to the memory of our eminent colleague, whose life was brimfull of the most fruitful work and activities. We beg his son, M. Robert Ellissen, the President of the Société Technique, and his bereaved family, to accept our most sincere condolences and the assurance of our very deepest sympathy."

Mr. SIDNEY FASSNIDGE, an Uxbridge solicitor, and one of the best-known men in the town, who died last week, was Vice-Chairman of the Uxbridge Gas Company.

FEDERATION OF GAS EMPLOYERS.

Yorkshire (West Riding) District Committee.

The Annual Meeting of the above-named Committee was held at the Bradford Corporation Gas Department Show-Rooms on Thursday, the 20th ult.

The annual report of the Management Committee showed an increase of five undertakings during the year.

The officers elected for the ensuing year were as follows:

Chairman: Mr. Charles Wood (Bradford).
Vice-Chairman: Mr. H. Townsend (Wakefield).
Management-Committee: Mr. C. Wood (Bradford), Mr. H. Townsend (Wakefield), Mr. R. Watson (Doncaster), Mr. W. B. M'Lusky (Halifax), Mr. A. Bromley (Keighley), Mr. C. S. Shapley (Leeds), Alderman H. Robinson (Ossett), Mr. H. Singleton (Huddersfield), Mr. F. H. Robinson (Harrogate), Mr. J. W. Turner (Mirfield), Mr. E. H. Hudson (Normanton), Mr. R. Halkett (Sheffield), Mr. H. E. Bloor (York), Mr. G. Lupton (Otley).
Secretary: Mr. F. D. Richmond (late of Heckmondwike) agreed to continue in office as Secretary until the appointment of a successor could be arranged.

Mr. Townsend was elected in place of Mr. F. D. Richmond as representative on the Regional Council.

The retiring member of the Central Committee, Mr. R. Halkett (Sheffield) was re-elected.

Mr. E. J. Fottrell and Mr. S. S. Ogilvie attended the meeting, and gave explanations on several matters of interest.

ELECTRICITY SUPPLY MEMORANDA.

WE congratulate the Institution of Electrical Engineers upon their President for this year—Mr. J. S. Highfield. His inaugural address was a delightful piece of composition, even to one who cannot positively subscribe to every period in it. It was philosophic and courageous; and axioms, originally expressed, abounded. He had something wise to say about education. Then he ran on to profits. He holds that in an individual's profits there should be sufficient to provide for new investments; for progress in science, engineering, and much else depends upon ability to do this. We agree with the President, while recognizing that in these times of high producing and buying costs, and the procedure of those who prescribe the extent to which a sovereign of profit shall be whittled down through rates and taxes, the resistances to saving for investment purposes have become very formidable. Then while Mr. Highfield approves of the concentration by electrical engineers upon the reduction of generating costs, he cannot understand why they should reduce the profits on electricity to vanishing point. But that is what many electricity administrators do, to the permanent weakness of their undertakings. Mr. Highfield believes in making a sufficiency of profit to allow of some being put into the undertaking, and so strengthening it that reductions in price must come as a natural consequence of the growth of business. The policy of charging prices that reduce profits to vanishing point, or make them a minus quantity, is possibly largely due to competition. He sees little good in effecting savings if they are all to be given to the public. Part of them should go into the industry, part to those who work in it, and part to those who venture their savings in it. With the high efficiency lamps of to-day, the President contends that the lighting consumer is not paying his fair share of the increased cost of providing him with electricity; and so power and heating charges are kept up. The electric lighting user paying from 9d. to 1s. 2d. will not heartily support this suggestion that he should pay more. However, the President favours the two-part tariff, the primary charge in which the masses could not afford to pay, and the man who can tries to deceive himself between the times of his payments of the primary charge that he is getting current cheaply. The President also yearns for a reduction in the cost of transmitting energy; and he refers to the "security" of electricity supply. He tells the manufacturers who "satisfactorily" run their mills and factories on a single gas or steam engine, and suffer occasional stoppages (which they regard as being unavoidable), that the electricity industry can give greater security than this without an undue amount of spare plant. Mr. Highfield should set about compiling a record of stoppages of electricity supply in industrial areas, as it seems that his knowledge of the inconstancy of electricity to the manufacturer and other users is not exactly in accord with facts. He also submits that electrical apparatus should be simplified, even at the expense of security, in order to reduce cost; but in this he will not have a majority of supporters. Among other points he urges that the purchase clause in the Electric Lighting Acts should be revoked. As we finish reading the address, the impression is deep that there is a lot wrong with the practices of the electricity industry that require putting right—if the President's criticisms are all justified.

Erroneous Electrical Practices.

Handicaps to Business.

As Chairman of the Liverpool Sub-Centre of the Institution of Electrical Engineers, Mr. G. H. Nisbett has taken the opportunity of frankly stating his views as to the methods of the electricity supply industry in relation to new business. He criticizes actions; and he commends a revision of them which would mean a tremendous additional financial obligation, which few electrical men will care now to entertain. He deplores that a supply of electricity is carried inside the front wall of a consumer's premises, and then that individual is left to his own devices as to how he shall use it. He makes application for a supply; and in response he is presented with a formidable form to fill up, accompanied by a set of wiring rules which suggest that he is proposing to admit to his house something that is as dangerous as T.N.T. Mr. Nisbett wants simplification of wiring; but, in his opinion, the Institution wiring rules have introduced complication into what should be a very simple matter. He urges that the business should not be hopelessly handicapped for the sake of the fire insurance companies; and, in his judgment, both consumers and insurance companies ought to be well content with any reasonably safe system of wiring, "if the electric light is to be used in substitution for gas, with its undoubtedly greater risks." This is a point about which people are getting more and more sceptical after personal unpleasant experiences with electricity. The "undoubtedly greater risk with gas" does not develop to actuality in use, especially having regard to the fact that there are between seven and eight million odd gas consumers in the United Kingdom, and less than a million electricity consumers, and that gas is used so extensively not only for light, but for heating, cooking, and power. Though Mr. Nisbett is so keen over the simplification of wiring, and so critical of the bad impressions created by the wiring rules, nevertheless he recognizes the need for the consumer being protected by suggesting that during the course of the wiring work, when carried out by a wiring contractor, the supply authorities' representatives should visit and inspect the job free of charge, and on satisfactory completion should issue a certificate to the consumer on which the contractor should be paid.

Who Should Find the Installation Money?

This payment is another handicap. With wiring costing from 30s. to £2 per point (without cost of appliances), the would-be user of electricity is quickly impressed by its uneconomy, and the demand for a long pocket. So Mr. Nisbett seriously suggests that supply administrators—men who are already worried over the expense of money and the difficulties of raising it—should consider carefully

the possibility of offering to wire to the ceiling-rose or equivalent on the premises for which supply applications are made. Some electricity suppliers will be of the opinion that Mr. Nisbett makes out a splendid case for not carrying-out his own suggestion, in view of the great speculation there is in free wiring, which is not removable the same as appliances on hire. The cost of an electricity undertaking in rendering supply, he himself shows, is already very heavy, and so is the price that has to be charged for energy. In neither the one nor the other direction will any alacrity be shown in increasing these items. He points out the seriousness of the installation cost to the consumer, and would transfer this "serious" cost to the supplier and to the charge per unit. This does not appear a very diplomatic policy in these times, in view of high costs. His case is that the total capital cost to the electricity works per lighting point (note the per lighting point!) connected to the mains averages about £2 5s., whereas the cost to the consumer of wiring from the main cut-out to the ceiling-rose or equivalent costs to-day (say) £1 10s. per point. So that the total capital per point is £3 15s. (excluding fittings), of which 60 p.ct. is found by the suppliers and 40 p.ct. by the consumers. The consumers' 30s. has to be multiplied by the number of points. Now Mr. Nisbett inquires how many householders will willingly spend this 40 p.ct. of the cost when the tenancy of premises may be short. So he holds that the provision of wiring free of initial expense would be met by results that would far outweigh the additional responsibility assumed by the electricity works. With free wiring there would, in his opinion, be an enormous influx of new consumers; but in the end the consumer would have to pay by an increased charge per unit, or by a separate rent charge. The consumers who would be obtained would be potentially of a lower order than those now on the mains, and so great care would have to be taken to make the additional charge, if on the unit, high enough to ensure a recouping of the costs of installation. Free-wiring has been discussed over and over again, and in financially happier times than the present. We think there will have to be a stronger case than that now put forward by Mr. Nisbett before electricity suppliers generally will contemplate the proposed course for cultivating business.

Manufacturers Collecting Power Cost Data.

Every electric undertaking is compelled to charge consumers the same price as other consumers whose custom is identical; but there is nothing that compels one undertaking to charge the same prices as another concern. This is well known to the Federation of British Industries; but the Federation appears to have irritated "Electrical Industries" by certain action which seems to indicate a nascent agitation among manufacturers over power rates. Manufacturers know that as between one undertaking and another there must be variations of prices, even though consumption by individuals may be somewhat similar. But in respect of electric power prices in a single area, there is often a lot of secrecy, and electricity supply departments will not (if it can be possibly avoided) divulge what contract prices are. This being so, manufacturers cannot know whether there is equality of price in like circumstances. Now the Federation of British Industries is constituted of manufacturers; and, if we understand "Electrical Industries" correctly, they are engaged in something that we suppose is regarded as a wicked conspiracy, in the matter of electricity costs. In 1920 the manufacturers were mutually interchanging electricity cost data without disclosing names. Now in the Federation "Bulletin" it is stated that, "owing to the downward movement of production costs, the old scale of charges no longer applies, and accordingly it has been decided to make a further interchange on present schedules, in which all members are invited to participate." Our contemporary says "the object of this scheme is, of course, to give members a lever for forcing down the cost of electricity for power." It would have been better to have said "for attempting to force down the cost," because manufacturers by comparing data of this kind cannot compel anything that is already well within the legal limits. Without this mutual communication of data, manufacturers, if they think they are paying more for energy than they should do, can easily arrange to instal private generating plant—just the same as manufacturers using gas for power purposes instal producer gas plant if the town supply is not available at what they consider, having regard to thermal value and purity, is a fair price in the circumstances of the times. However, we do not suppose the Federation will feel in the slightest degree affronted or disturbed over the opinion of our contemporary that "there is not only something unworthy of the Federation in these underground tactics, but there is something ludicrous." The Federation has in the membership many hard-headed business men; and possibly they will be highly amused. However, if electricity undertakings have nothing to fear as to the fairness of their charges, why protest against what the Federation is doing?

Salesmanship Conferences.

The activities of the Electrical Development Association are spreading. A series of "Salesmanship Conferences" has been arranged by them. To these conferences all interested in the purveying of electrical energy or appliances are invited, and particularly those who come into direct contact with the consumer. There are to be half-a-dozen of these conferences during the winter; and at the first one, which was held last Friday, the subject for consideration was "Salesmanship in Wiring and Installation Work." The conferences are held more particularly for the information of a class of electrical workers different from those attending the district conferences of the British Commercial Gas Association. The discussions should be informative, educative, and valuable just in the zone of electrical activity where are most required education and information as to the advantages of the practices in different supply areas.

The Scheme for the West Riding.

In the King's Speech proroguing Parliament, it was remarked: "The imperative need for the avoidance of all fresh burdens, and for the further curtailment of expenditure, has required the modification of some measures already passed, and the postponement to happier times of the completion of other reforms." There is a considerable amount of doubt existing in technical circles as to whether the electricity schemes for the concentration of generation, with distant transmission, can be properly called a "reform." But anyway not much progress can be made with the schemes until financial powers are passed in some form—whether as proposed by the Electricity Supply Bill No. 2, or some other form, is a question for the future. But anyway that is one of the measures that has been postponed to "happier times." Apart from electricity supply, we hope these times will not be long coming. The reference in the King's Speech is called to mind by the issue of the decision regarding the reorganizing of electricity supply in the West Riding area. The area provisionally determined has been somewhat altered by the inclusion of adjoining territory. The interconnection is contemplated of the existing generating stations at Bradford, Halifax, Huddersfield, Keighley, Leeds, Thornhill, and Wakefield. The extensions already authorized, and the addition of another generating set at the Whitehall station of the Leeds Corporation, will, it is said, with the interconnection meet the estimated requirements for several years. Supplementing, the Yorkshire Electric Power Company are authorized to proceed with the construction of the first stage of their new power station at the Ferrybridge site. This will be linked-up with the interconnected system. The Electricity Commissioners propose a Joint Electricity Authority for the whole district as amended; but pending this the principal local authority undertakings and the Power Company are to form a small Provisional Committee, with whom the Commissioners may consult with regard to any development of supply in the district. For transmission purposes, it is advised that the district should be dealt with in two agreed areas—one being supplied from the municipal stations, and the other by the Power Company, provided that all the interconnected stations are worked under one control and for mutual assistance. The Power Company will no doubt be able to get the money they require for their part of the work; but the source of the Joint Authority's finance is not, in the absence of parliamentary powers, capable of precise definition.

THE HAWARD MEMORIAL LECTURE.

BEFORE the Imperial College Chemical Society on the 11th inst., Prof. William A. Bone delivered a lecture dealing with the life-work of Mr. William Arthur Haward, who met a tragic death last December in circumstances detailed in the "JOURNAL," Vol. CLII., p. 630.

Dr. Bone said: Though, in the course of our researches, experiments involving personal risk have sometimes to be undertaken, it has fortunately but seldom happened that accidents arising therefrom have resulted in serious injury to the investigators concerned. Such risks, however, are undertaken daily by scientific men the world over; and no one can engage in research without incurring them at some time or other.

It was as the result of one of these rare accidents that the career of William Arthur Haward, a member of this Society and a Salters' Research Fellow, was so tragically ended by death on the 6th of December last, while he was actually engaged upon some final experiments which had been expressly designed to test and develop some important theoretical issues arising out of a research in which he had collaborated with me during the two preceding years. We are met together this afternoon, not so much to consider his experimental results—important as they undoubtedly are—as to pay a tribute to the memory of one who laid down his life in the cause of science, and whose work was illumined by a most true and lovable character.

The main incidents of his career among us are soon told. He received his school education principally at the Dame Alice Owens Secondary School, Islington, where he held a Junior County Council Scholarship and gained various prizes and distinctions, chiefly in mathematics and chemistry. Thence he entered this College in October, 1912, with a Royal Scholarship, and two years later he took the College Associateship as well as the London B.Sc. degree with first class honours in Chemistry. He thereupon decided to take up a course of post-graduate study and research in the Department of Chemical Technology; and it was thus that I first became associated with him. It did not take me long to realize that a man of quite exceptional calibre had come among us. There was that undefinable "something" about him which arrested attention, and inspired not only peculiar confidence in

his powers, but also the conviction that, given the opportunity, he would go far. It was quite clear that, both by temperament and gifts, he was marked-out for a career of scientific research; and this he steadfastly followed (with a short interlude of war-work at H.M. Explosives Factory at Gretna) till the day of his death.

The lecturer then briefly dealt with the results of Haward's first researches (as yet unpublished) which were connected with the influence of water vapour upon the surface combustion of carbon monoxide at low temperatures. These he carried out at the Imperial College during the session 1915-16; and he successfully submitted the results thereof as a thesis for his M.Sc. degree of the University of London.

He spent the summer vacations of 1915 and 1916 in researching, under Dr. R. V. Wheeler's direction at the Home Office Experimental Station at Eskmeals (Cumberland), upon the limits of inflammability and the rates of flame propagation [" the uniform movement "] through hydrogen-air and acetylene-air mixtures respectively. These experiments were subsequently published by him in the " Transactions of the Chemical Society."

In June, 1916, he had the honour to be elected to a Beit Research Fellowship at the Imperial College. This, however, he resigned the following December, feeling it incumbent upon him to relinquish for the time being fundamental research work, in order to do some definite war-work. He accordingly joined the Chemical Staff at H.M. Explosives Factory at Gretna, where he remained until shortly after the armistice.

In December, 1918, he was elected to a Salters' Research Fellowship, with which he returned to the Imperial College, in order to collaborate (at his own particular desire) with Prof. Bone in researches upon gaseous combustion at high pressures. The work upon which he thus became engaged was a continuation of the similar work which Prof. Bone and collaborators had carried out in former years at the University of Leeds, and whose results were subsequently published in the " Philosophical Transactions of the Royal Society " in 1916. The results of Haward's further experiments, which the lecturer next proceeded to describe in detail, have recently been published in the " Proceedings of the Royal Society." Through the courtesy of the Council of the Society we are permitted to reproduce this paper; but it has been crowded-out of the current issue of the " JOURNAL."

It was in attempting to carry out the first of a final series of experiments designed to test the validity of the theory outlined in the Royal Society's paper that (said Dr. Bone) Haward's career was cut-short by death in the late afternoon of Monday, Dec. 6 last. We had fully discussed them together on the preceding Friday; and, as Haward wished to complete the experimental part of our programme before the end of the year, when his fellowship would have expired, it was decided to go ahead, particularly as the apparatus was undoubtedly in first-rate working order, having only recently been overhauled by the makers. There are, however, some grounds for believing that, after the constituents of the mixture had been severally introduced into the bomb, he inadvertently omitted a certain procedure which was normally carried out with the object of thoroughly mixing them, and that he did not become aware of this omission until some minutes later, after he had drawn a sample of the mixture and made several other adjustments preparatory to firing it. On becoming aware of the mistake, which he doubtless at once realized would render the experiment nugatory, he probably decided to (so to speak) cut it short. With this idea in mind, he thereupon fired the mixture, forgetting that he had neither shut-down the valve of the bomb " explosion tight " nor broken the connection between it and the standard Bourdon gauge. It was probably the first such mistake he had ever made during the research; and he paid the penalty with his life. Be that, however, as it may, he laid down that life nobly in the cause of science, leaving behind him an enduring contribution to its progress; and, in so dying, he lives.

It would not be fitting for me to close this brief account of his researches without some reference to those natural gifts and qualities of mind which made him so fine an experimentalist. It has been my great privilege to number among my research students and collaborators several highly-gifted young men, who in their subsequent careers have made for themselves reputations in the field of experimental science; but I can remember none who, in what may be termed the probationary part of their careers, showed so great a promise of after-development as did Haward. Haward always impressed me as possessing, in an exceptionally high degree for a man of his age, all the qualities requisite for the making of a great experimentalist; and had he lived, and been able to develop his powers further, I feel confident he would have earned for himself a place in the front rank of scientific investigators.

In the first place, he had a wonderful manipulative ability, which disclosed itself in almost his every action in the laboratory. His hands were wonderfully deft, and his touch seemed to be instantly responsive to the requirements of every kind of manipulation. He had a calm and quiet demeanour; and in his movements was one of the most circumspect and deliberate men that I ever worked with. He possessed infinite patience, great tenacity of purpose, and he never seemed to be flurried by unexpected happenings, nor in the least discouraged when difficulties gathered thickly around him. He had the instincts of the true artist—never being satisfied with anything but the very best attainment. I have seen him devote hours of thought and work to effect, for his own satisfaction, some slight improvement in his apparatus or results which most other workers would have considered hardly worth while troubling about. He kept such clear and systematic records of his experiments, all duly analyzed and marked with cross-references, that even after his death it was possible for me to go through them all without finding any material point on which they were deficient, or on which they were not perfectly clear and explicit. They are decidedly the best records ever produced by anyone working under my direction.

As for the man himself, his most conspicuous quality was his innate modesty, which however was admirably combined (as it is in the best men) with the right kind of self-confidence, and consciousness of capacity. During my long association with him, I cannot remember any occasion when he unduly asserted or put himself forward. On the other hand, I never knew him to excuse himself from any duty or responsibility which was put upon him, or to fail in the smallest particular in carrying out to the utmost anything that he had undertaken to do. He was passionately devoted to scientific research, and his only concern seemed to be that, somehow or other, it might be made possible for him to make it his lifework; and I always felt him to be the kind of man who, having " set his hand to the plough," would not be turned back. He had a very great influence for good over his fellow-students and research assistants; and, indeed, the whole of the department seemed to be the better for his presence in it. After his death, I received many sincere expressions from his fellow-workers of the influence which his example had had over them. I think it may truthfully be said of him, that his character and gifts were such that death could not destroy, and that in the Hereafter, which we can realize by hope, however little we may know about it, his gentle but unquenchable spirit will find its exceeding great reward.

The Metcalfe-Shaw Tar Emulsion Separator.

The Metcalfe-Shaw process for dehydrating tar emulsions, particularly from water-gas plants, in its simplest form can, it is stated, be explained as the action of capillary forces which exist where fluids are in contact with closely approaching surfaces, or with bundles of tubes or rods of very small diameter, which overcome the surface tension forces that appear to characterize emulsions. The globules of water in tar emulsions are surrounded and held by the tension of the tar. Through capillary action it is probable that either the water or the oil is taken first, permitting the globules to unite into larger globules, thus breaking-up the emulsion. In other words, the method depends upon the use of one natural force to overcome and destroy the effect of another natural force. The apparatus consists of a combination of tanks, motor, shafting, rollers, link-belt, and conveyor-band. There is a continuous belt consisting of mops, each of which is in construction somewhat like the fringes on the edge of woven household fabrics. These mops are sewn across the conveyor-band with a suitable margin at each edge. The length of the mop being about 6 in., and being sewn on at intervals of 1 in., there is at any given point across the conveyor-band a total depth of six of the thin mop layers. The conveyor-band carries round this continuous mop, travelling down into the tank of emulsion, over a bottom roller, and up to the top roller, where it is squeezed between suitably-placed adjustable rollers, and can be made to deliver a constant stream of commercially dry tar and water without personal supervision—which makes the cost of operation sufficiently low to be profitable. The tank is in two compartments. The first, or emulsion, compartment of 300 gallons capacity is provided with a float-controlled valve, which allows the emulsion to flow into the tank from the relief holder up to a certain level. The second compartment of 600 gallons capacity receives the treated emulsion discharge, and is large enough to allow time for stratification. The apparatus is made by the Metcalfe-Shaw Corporation, of Church Street, New York.

Southern Association of Gas Engineers and Managers.—The annual general meeting of the Association will be held on Tuesday next, at 2.30, in the Charing Cross Hotel. In addition to the formal business, two papers will be presented: " Organization and Administration of a Distribution and Sales Department," by Mr. W. J. Sandeman, of Croydon; and " A Method of District Pressure Control," by Mr. P. S. Hoyte, Assoc.M.Inst.Mech.E., of Plymouth. At the termination of the business, afternoon tea will be served.

Seventy-Mile Pipe-Line.—As the result of negotiations between the Ohio Oil Company and the Billings (Mont) Gas Company, there is under construction a gas pipe-line from the Elk Basin field, 72 miles south of Billings, to that city. More than 500 men are employed on the work. Not only will natural gas be supplied to Billings by this line, but half-a-dozen other communities, to say nothing of rural homes along the line, will benefit by the project. The supply for the pipe-line will come from a big " gasser " in the Elk Basin field which blew in last year with a flow of upwards of 100,000,000 c.ft. per day. The maximum flow of this well has never been ascertained, because of the fact that the largest recording device of the kind made (capable of measuring 100,000,000 c.ft. of flow) broke down under the volume and pressure that the well turned into the meter. The well is one of the largest " gassers " in America, and is conservatively estimated at a capacity of 150,000,000 c.ft. per day. It is in the centre of a great area of gas production, the potentialities of which are so immense that they cannot be calculated.

PUBLIC WORKS, ROADS, AND TRANSPORT CONGRESS.

In connection with the Public Works, Roads, and Transport Congress at the Royal Agricultural Hall, Islington, concurrently with an exhibition, there is being held a series of conferences, arranged by various organizations to cover different subjects. The whole of last Friday (this was the first of the series) was devoted to a conference arranged by the Institution of Gas Engineers, at the request of the General Committee of the Congress, to deal with public matters of importance to the industry. Four papers were presented; and two, in somewhat abbreviated form, together with a report of the discussions, are reproduced to-day. The chair was occupied by Mr. THOMAS HARDIE, Deputy Chief Engineer of the Gas Light and Coke Company, and President of the Institution of Gas Engineers. There was a gratifying attendance; and the day proved to be a very full one. Only summaries of the printed papers were given, with the result that plenty of time was available for discussion. A number of interesting and useful matters were dealt with by the different authors and speakers.

WELCOME.

The CHAIRMAN said that, before calling upon the authors of the first paper, he would like to offer a word of welcome to those attending the conference. He was pleased to see so satisfactory an audience. As they knew, the papers for the day had been arranged by the Institution of Gas Engineers; and all were allied with the subject of gas. It was at the beginning of the last century that gas was first used for public lighting in the streets; and since that time gas undertakings had been much interested in the maintenance and construction of roads. The right to enter and to take-up public roads, of course, had carried with it certain responsibilities; and these responsibilities had not decreased with the great increase in the weight and the number of vehicles passing over the roads. But it was not with this subject that the papers would deal. They touched rather upon the benefits and advantages which the use of gas had conferred upon transport. One of the papers would deal with street lighting, and indicate the greatly increased efficiency of it; the second, with the advantages of the use of home-produced spirit for motor transport; the third, with the advantages to be obtained by the adoption of tar for the construction of roads; and the fourth, with the benefits of an improved atmosphere attainable by the use of gaseous fuel. The first paper was by the Distribution Department of the South Metropolitan Gas Company; and he would call upon Dr. Thomas to introduce it.

Dr. J. S. G. THOMAS (South Metropolitan Gas Company) then summarized the following paper.

PUBLIC LIGHTING.

By the DISTRIBUTION DEPARTMENT OF THE SOUTH METROPOLITAN GAS COMPANY.

MEASUREMENT OF LIGHT AND ILLUMINATION.

After some historical remarks, the authors went on to say that a system of perfectly definite units must be available for the specification of any system of lighting. In no branch of applied science do the several units employed—their designation and definition—appear to have been chosen more unfortunately than is the case with those used in illuminating engineering. Such confusion prevails in this connection that even from standard works on the subject no clear conception can be derived of the significance of these various units. Within recent years the introduction of various new units and entities into the nomenclature of the science has served but to make confusion worse confounded; and the whole subject stands in need of considerable reform, if the progress of illuminating engineering is not to be hampered by a plethora of units, &c., badly named and even worse defined.*

Two factors stand out crystal clear in matters connected with any system of lighting—the power of the light sources and the illumination produced thereby. In the great majority of, if not in all, practical illuminating problems, the introduction of considerations of luminous flux, lumens bringing with them the factor 4π, the lux, the phot, &c., is quite unnecessary. In the sequel we will concern ourselves solely with the candle power of the source and the illumination expressed in foot-candles thereby produced. Parenthetically, it may be remarked that the unsuitability of the term "foot-candle" from the physical standpoint is realized. The term connotes the illumination of a surface distant 1 ft. from a light source of 1 candle power. The incompatibility of the unit mination as 1 "Murdoch"—thus following a practice customary in and its designation is removed by referring to such a unit of illu- electrical and other sciences, of commemorating the pioneers of the science. The practice could be extended, with profit, throughout the science of illuminating engineering. Many devices are available for the measurement of the candle power of the source and of the illumination produced.

CRITERIA DETERMINING THE CHARACTER AND EFFICIENCY OF STREET LIGHTING.

We think it will be universally agreed that, before any system of public lighting can be considered satisfactory, regard must be paid to the following factors:

(1) Adequacy of the illumination provided.
(2) Steadiness and constancy of the light sources.
(3) Absence of glare.
(4) Cost to be a minimum compatible with the provision of adequate service.
(5) System to be such that national fuel resources are conserved to the utmost.

Referring to these in the reverse order to that above, we may remark under (5) that, while the work of Sir Dugald Clerk, Prof. Smithells, and Prof. Cobb* has shown there is little to choose in the matter of national fuel economy in the production of light, whether by the consumption of gaseous or electrical energy, nevertheless for the majority of operations involving the utilization of energy for the production of heat, light, and power, national fuel resources are best conserved by the utilization of the energy of such resources in the gaseous form. It may therefore be fairly anticipated that the best interests of the country would be served by an extended adoption of the system of public lighting by gas, as such adoption must inevitably be accompanied by an extended use of gaseous energy in other directions.

The consideration that the cost of the system is to be a minimum compatible with the provision of an adequate service, is the very *crux* of the problem of public lighting. Probably there would be no problem of public lighting, did considerations of cost not enter into the matter. Such matters as height and distribution of lamp-posts, the disposition of these so as to interfere as little as possible with traffic and the ordinary amenities of life, and most other factors entering into the matter of a system of public lighting—all are ultimately attributable to the entry of cost into our considerations. These have been matters of keen controversy; and we do not propose to discuss them further here. In the sequel, reference is made to the practice of the South Metropolitan Gas Company in some of these matters.

Passing to the consideration of glare, we may remark that some authorities go so far as to hold that the physiological efficiency of a system of public lighting, more particularly as regards absence of glare, is of more vital importance than the visual or illumination efficiency of the system. It has been suggested that, in a system of public lighting from which the phenomenon of glare is absent, the standard specification of illumination should be considerably reduced, as it is held that illumination is very much more efficiently utilized in the absence of glare. The subject of glare has been written about almost *ad nauseam;* and we appear to be nearly as far off as ever from a scientific analysis of its causes and physiological effects. The matter, however, has become of such extreme importance within the last few years—principally owing to the use of unscreened gas-filled electric lamps—that it merits some little attention here. The cause of glare is almost always to be traced to the direct exposure of the eye to an unscreened light source whose light emission per unit area of surface is greater than a certain amount—that is to say, glare is attributable to too great an intrinsic brilliance of the luminous source. Exposure of the eye to such a source causes temporary contraction of the pupil, together with a temporary, or in some cases possibly a permanent, paralysis of the optic mechanism. Approximate figures for the intrinsic brilliancies of certain luminous sources are set out.

TABLE I.

Luminous Source.		Intrinsic Brilliance. Candle-Power per Square Inch.
Moon		2
Sky (average brightness)		2·5
Candle		2·5
Petroleum lamp		5
Gas-Burners	Flat-flame	2–5
	Argand	7·5
	Acetylene	10–25
	Low-pressure incandescent	40
	High-pressure incandescent	250
Electric Lamps	Carbon filament	400
	Tungsten metallic filament	1,100
	Gas-filled	5,000
	Pointolite	12,900
	Electric arc (naked)	20,000
Sun		800,000

* See Report International Commission on Illumination, Paris, 1921. See "JOURNAL" for Oct. 19, p. 226.

* Report on the Coal, Gas, and Electrical Supply Industries of the United Kingdom to the President of the Institution of Gas Engineers, 1919. See "JOURNAL," Vol. CXLVI., p. 235.

The figures show clearly the tendency accompanying the development of more efficient sources of illumination for the intrinsic brilliancies of such sources to increase. It will be observed from the table that the average intrinsic brilliance of the sky is about 2·5 candles per square inch; and there is some reason to believe that the evolution of the human eye has occurred along lines such that it does not experience the effects of glare when exposed to sources whose intrinsic brilliance is of this order of magnitude or less. The effects of glare are entirely avoided by screening the light sources so that the apparent intrinsic brilliancies do not exceed such limit; or, alternatively, care must be taken that the eye is not directly exposed to any source whose intrinsic brilliance exceeds this amount. Thus the Departmental Committee on Lighting in Factories and Workshops Report [Cmd. 1418, 1921] recommends that every light source (except one whose intrinsic brilliance does not exceed 5 candles per sq. in.) within a distance of 100 ft. shall be shaded so that no part of the mantle, filament, or flame is distinguishable through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of the source and a horizontal plane is not less than 20°. An elaborate system of rules for the avoidance of glare has been drawn up by Weber. Outside a certain angle between the ray and the horizontal, protection is naturally afforded from the effects of glare by the structure surrounding the eye. Results obtained in a test of street lighting in New York indicate that, in a street one-half of which was illuminated by lamps equipped with diffusing globes and the other half by lamps with clear globes, the former portion was unanimously chosen as the better lit part—despite the fact that the latter portion afforded the greater illumination.

The necessity for steadiness and constancy of the sources of illumination in a system of street lighting needs no emphasis. In the matter of street lighting by gas, the necessity is readily and easily met by ensuring a constant supply of gas possessing constant physical characteristics at a constant pressure for consumption in standardized burners—due attention being paid to certain points concerning the maintenance, &c., of such appliances. These matters are referred to more specifically later, when one method of street lighting developed in the area of supply of the South Metropolitan Gas Company is described.

The remaining matter concerning the illumination afforded by a system of public lighting is an extremely controversial one; and as yet no decision has been reached as to how the lighting of roads and streets is best specified, nor in what manner the adequacy or otherwise of the installation is best ascertained. Nothing approaching a consensus of opinion has hitherto been found possible on these extremely important matters; and a little consideration will show that at this stage full agreement on these points is hardly to be expected. The science of illumination and the cognate art of illuminating engineering are only beginning to be widely apprehended. Lamps and burners employed in public lighting by gas and electricity throughout the country are legion, and differ from one another even as the stars in glory. Their characteristic polar distribution curves are of varied forms; there is no standard height above ground-level at which the lamps are fixed; nor are they separated by any standard and invariable distances. Apart altogether from such considerations connected with the light source, we have the additional complication that the roads, streets, pavements, &c., to be illuminated are almost infinitely diversified. Moreover, there is no single manner in which the illumination provided is utilized. For some purposes illumination distributed over a vertical plane is desirable; for others horizontal illumination alone is required; while yet again, vision in the streets may be aided by the absence of illumination from the object viewed, which then appears as a dark object silhouetted against a bright background. Attention has been directed to the importance of this mode of utilization of illumination by Millar, who has specified the following as the elements determining the effective brightness of street illumination:

Effective brightness of street	Incident flux	Flux per lamp.
		Distribution of light.
		Height and spacing of lamps.
		Lamp equipment.
	Uniformity	Distribution.
		Height and spacing.
		Lamp equipment.
	Light reflecting quality of street	Co-efficient of reflection.
		Angle of incidence.
	Angle of incident light.	
	Direction of light.	Location of lamps.

A consideration of the table and the matters briefly referred to above, renders it exceedingly improbable that a specification based upon one mode of testing only can do equal justice to all the systems of street lighting. The differences in the characteristic polar curves of different types of light sources alone almost preclude such a possibility. Hitherto in this country street lighting specifications have been based almost entirely on a candle-power basis, rather than on an illumination basis. In this connection, it is important to remember that the determination of the adequacy or otherwise of a system of street lighting on the basis of minimum horizontal illumination, as has been suggested, is only at all possible in the case of some 20 p.ct. or so of such systems. This arises owing to the fact that most thoroughfares—such as country roads, &c., having little traffic—merely require the light sources to serve as beacons, indicating the direction of the road, position of the kerb, &c. In general, the illumination afforded in such roads falls below the possibility of accurate measurement by means of illumination photometers, of which several excellent varieties have become available in recent years.

Most valuable work has been done by Trotter* in the matter of the classification of systems of street illumination. The classification suggested is based upon a measurement of the minimum horizontal illumination afforded at a height of 3 ft. 3 in. above the street-level; and it is worthy of note that, though the various systems providing the illumination were erected and tested to a candle-power specification, and not on the basis of a specification involving the consideration of such minimum illumination, the former mode of specification has hitherto succeeded in providing systems of street lighting in which the illumination has been found adequate to the character of the traffic, &c., in the respective streets. This is clearly evidenced by the results given in Trotter's table, and is to be expected, as in reality the two modes of specification are not entirely independent; the illumination at any point in any given case being readily deducible from the candle-power and polar distribution curve of the sources, though the reverse calculation would be lengthy, and would require a specification of the illumination throughout the whole field surrounding the light source.

The classification of streets based on the minimum horizontal illumination occurring therein is as follows:

TABLE II.

Class.	Minimum Horizontal Illumination (Foot-Candle).
Undesignated	Below 0·01
A	Not less than 0·01
B	,, 0·025
C	,, 0·04
D	,, 0·06
E	,, 0·10

Roads whose minimum horizontal illumination is not less than 0·025 foot-candle would be first-rate main lines of thoroughfare. Auxiliary and relief roads would have a minimum horizontal illumination of between 0·015 and 0·025 foot-candle; while in side and unimportant streets, the minimum horizontal illumination would be below 0·015 foot-candle. The classification is in accord with the results obtained by the visual observations of expert surveyors. On the result of the photometric observations upon which the above classification of roads and streets is based, a series of clauses was suggested for the specification of street-lighting systems on the bases of the minimum horizontal illumination such systems afford. There is much to be said, and much has been said, both for and against such a mode of specification. The shortcomings of such a system of specification have perhaps been best analyzed by Millar. It is unnecessary to detail his criticism here; but it is important to note that while, as he states, a similar proposition was made in America in 1907, the majority of American experts in illuminating engineering are agreed that adopting such a specification would be a retrograde step.

Any specification for street lighting must be based upon photometric measurements, either of candle power or of illumination. Measurements of illumination may be termed "secondary measurements"—the instruments employed therein requiring to be checked from time to time against the primary standards more customarily employed in the direct measurement of candle power. The specification of street lighting on an illumination basis does not, therefore, do away with the necessity for a photometric laboratory in which the secondary illumination standards may be checked. Direct photometric measurements are still necessary; and considering that 80 p.ct. of street-lighting systems must, as already remarked, be inevitably determined on a candle-power basis, it seems not unreasonable to maintain that street lighting should be based, so far as the light sources are concerned, on a specification of the candle power to be provided, and the essential characteristics of their polar distribution curves. Measurements of illumination, where necessary, whether horizontal, vertical, or total, might then be employed in order to specify suitable heights, spacing, &c., of the light sources.

Before passing to the consideration of the practical system of public lighting adopted by the South Metropolitan Gas Company, it is interesting to note the changes which have resulted during the last decade, consequent upon the adoption of improved methods in the art of illumination by town's gas, within the area of supply of the Company. From Table III. it will be noted that, whereas in the year 1899 the streets of South London were illuminated with a value equivalent to that afforded by 280,000 candles, in 1902 the figure had increased to approximately 1,270,000 candles, with an increase of only 4 p.ct. in the number of lamps, and a decrease of approximately 20 p.ct. in the total annual consumption of gas in the lamps.

The extension of the system of lighting by inverted incandescent burners was temporarily postponed from causes connected with the war; and figures for years subsequent to 1913 do not afford a fair basis of comparison owing to the existence of regulations restricting the public lighting of London during those years.

In regard to the marked increase of efficiency of public lighting shown in the above table for 1902, the following remark from the report of the Company for the half year ended December, 1900, is of interest: "The Directors think that it may be interesting to

* See "JOURNAL," Vol. CXXII., p. 250.

the shareholders to be informed that they have induced the local authorities to adopt incandescent gas lighting. This system is now the rule almost throughout the Company's district." The increased efficiency of public lighting due to this introduction of upright and inverted incandescent burners is clearly seen from the table.

TABLE III.

Year.	Number of Public Lamps.	Gas Consumption (Million Cubic Feet per Annum).	*Equivalent Candle Power.	Candle Power per Cubic Foot of Gas Consumed per Hour.	Remarks.
1899	20,998	478	280,000	2·5	Flat-flame burners throughout district.
1902	21,800	359	1,270,000	14·0	Upright incandescent burners throughout district.
1913	24,713	371·5	1,700,000	19·0	8000 upright burners replaced by inverted incandescent burners.

* Based upon a lighting period of 4200 hours per annum.

The matter of public lighting, as, indeed, of all matters of gas supply, has been considerably simplified within the last year or so by the operation of the Gas Regulation Act, 1920, under which gas companies are at liberty to declare the calorific value of the gas to be supplied by them, and thereafter are to maintain the supply of gas at such calorific value. Gas possessing constant physical and chemical characteristics has been supplied by the South Metropolitan Gas Company for some years. The declared calorific value of the gas supplied at present is 550 B.Th.U. per c.ft. This is not the place to enter into a discussion of the question of high-grade *versus* low-grade gas. The Company's supply would certainly be termed high-grade gas; the term connoting that the potential thermal energy of the gas is supplied in comparatively high concentration. The point all essential to the present discussion is that, whether the supply be of high concentration or of low concentration, the possibility of a constancy in the physical characteristics of the gas—not necessarily the same in areas supplied by different companies—renders it for the first time possible to supply to consumers, and, not least important among them, to public lighting authorities, gas which, when consumed in suitable burners, shall perform a definite and predetermined duty. In other words, the possibility of standardizing gas-consuming appliances is one of the blessings conferred upon the gas industry by the operation of the Gas Regulation Act.

This possibility sets the matter of public lighting by gas upon an exact quantitative basis—a condition of affairs, we would contend, eminently satisfactory both to the public lighting authorities and suppliers of gas. Hitherto, half-hearted attempts have been made to cope with the changes in the composition and properties of town's gas employed in public lighting, by the provision of devices for the adjustment of the hourly rate of consumption of gas by the burner, and of the air induced thereby. The deficiencies of such a system of adjustment are, we think, sufficiently obvious to need no comment. Long experience of the matter in the area of supply of the South Metropolitan Gas Company enables one to assert confidently that burners without gas or air adjustments can be designed which will afford an efficiency deviating little from a pre-ascertained value, provided that the calorific value of the gas does not depart from the declared value by more than ± 25 B.Th.U.

The endeavour of the South Metropolitan Gas Company to achieve a satisfactory system of public lighting under these conditions resolves itself into: (1) The experimental determination and specification of a burner suitable for use under the extreme conditions met with in its subsequent use in the streets; (2) the assembling of component parts for the bulk manufacture of such standardized burners; (3) the verification from time to time of the duty rendered by burners supplied in bulk; and (4) further experimental work tending to enhance the efficiency of the appliance. In this connection, we would understand by "burner" the assemblage of all parts of the completed lamp, the burner proper, the lantern, reflector, &c. Each and all of these parts must be the subject of continuous improvement in the light of growth of knowledge in the utilization of gaseous energy.

Little need be said here under (1). Street lighting units have been developed as the result of continuous research having as its goal the specification of burners making possible the attainment of the maximum efficiency in the combustion of gas. The bulk manufacture of a standardized burner reduces merely to the assemblage of carefully gauged parts in accordance with specified standards.

For purposes of comparison, curves have been drawn on a uniform basis showing the candle power in various directions, per $\frac{1}{100}$th therm of gaseous energy supplied, with the so-called 14-in. "Windsor" upright Kern street-lamp, the 120-c.p. "South London" 4-ft. street-lamp, and the "South London" three-light street-lamp, provided with preheater. Particulars of the various curves are collected together in the table below.

Attention may here be directed to the difference in the forms of the respective polar curves of the upright and inverted types of burners respectively. The radial candle power of the lamp is very much more uniformly distributed throughout the lower hemisphere in the case of the inverted burner than is the case with the upright. The difference in such characteristic curves is even more marked in the case of other sources of illumination, more especially certain forms of electric lamps, and points to the necessity of regard being paid to such curves in matters concerning any specification of street lighting.

TABLE IV.

Lamp.	Hourly Consumption.		Mean Candle Power.		
	Cubic Feet.	Therm.	Per Cubic Foot per Hour.	Per $\frac{1}{100}$ Therm per Hour.	Mean Candle-Power. (Mean per Therm × Consumption.)
14-in. "Windsor" Kern street-lamp (upright)	2·73	0·0150	12·9	23·5	35
"South London" lantern, 4-ft. burner (inverted)	4·15	0·0228	28·5	51·8	118
"South London" 3-light street-lantern, with superheater (inverted)	6·37	0·0350	36·0	65·4	229

[Numerous illustrations accompanied the paper.]

DISCUSSION.

Mr. HAYDN HARRISON said he was sure they would all, with him, wish to thank the authors for bringing forward a badly-needed paper at such an opportune time. There was not the slightest doubt that during the war the question of public lighting had to be put very much on one side; but it was obvious from the paper that the workers in the South Metropolitan Gas Company were proceeding steadily with some very valuable work in connection with the gas lighting of roads. The paper would prove a record of progress so far as low-pressure gas lighting was concerned; and, of course, this was the most important feature. Throughout the country he believed that the percentage of high-pressure gas was very small as compared with the low. It was quite impossible to agree with everything in any paper; but there was very little in the present one which he could criticize. Dr. Thomas had, however, opened up a very important question, in connection with suitable units in which to describe results obtained. He wished that Dr. Thomas had been by his side a few years ago, when he (the speaker) fought as hard as he could against the adoption of the lumen—that was to say, the unit of luminous energy being the primary unit. But it was no good; and he noticed that by the International Commission on Illumination a few months ago the lumen, or unit of luminous energy, had been put down first as the primary unit. There every nation of any importance was represented, and particularly their American friends, who they all knew dealt nearly always with lumens in their work; and they were able to a large extent to substantiate their case. He found one thing in the paper which went to prove that a unit of light energy was of enormous importance, because in Table IV. the light value was stated in "mean candle power." Now, this particular unit was not even mentioned, so far as he could remember, at any of these conferences he had referred to; and he would like to know what the authors really did mean to convey by mean candle power. What it was actually the "mean" of, he could not quite see. As everybody knew, there had been a certain amount of discussion as to how street illumination should be measured and specified; and a Joint Committee (consisting of representatives of all interested in public lighting) sitting, he believed, in 1912, spent a considerable time in getting out suggested standard clauses; and as a member of the Committee who went very carefully into these matters, he gave it as his opinion—and he was glad to see that this opinion was borne out in the paper before them—that in at least 80 p.ct. of the cases one could not measure the minimum illumination of a street, because it was too low to do physically; but one could accurately ascertain the illumination by measuring the candle power of the rays which did reach the distant point. This was what he thought the authors agreed with him upon. If they measured the candle power as he had said, then they got a criterion of the minimum of illumination. Therefore he sincerely hoped that, if any specification was ever drafted which would satisfy anybody, it would contain as one stipulation the candle power at an angle which covered at least half the street. The question of glare came up in connection with nearly every paper with which he had to deal relating to lighting. Glare had never yet been defined in such a way that people would agree that the definition was correct. What everybody did agree with was the recommendation to which attention was drawn in the paper—that a highly brilliant source must be so placed that the angle between the line from the eye to an unshaded part of the source and a horizontal plane was not less than 20°. He had seen the figure put at 30°. This was a sensible definition, and to his mind a correct definition, of glare. The only thing that prevented glare reaching the eye was what Nature gave them—that was, their own eyelids. By natural instinct, they did not allow glare to enter their eyes; and provided they could see things they wished to see without looking at the glare source, they were satisfied. But if glaring light sources were in such a position that one could not look at the desired objects without seeing these sources, then glare was a disadvantage. This was all in favour of raising the height of lamps in streets; and it was also an argument in favour of keeping the power of the lamps down as one approached them. Everybody knew that if they got far enough away from what would be called a glaring light source, it would not bother them; but it was when they came close, unless it was possible to protect the eyes by natural means, that they suffered from glare.

Mr. W. J. LIBERTY (City of London) said the question of lighting not only the roads now existing, but the great arterial roads which were about to be formed, should be approached from the point of view of scientific illumination—*i.e.*, surface brightness, that which could be measured and tabulated—instead of regarding illumination as a light source, consisting of so many candles or candle power. Whatever the

source, they wanted to get away from the intrinsic brilliancy, and to deal with the illumination of any part of a surface, or the uniformity with which such surface was illuminated. For street lighting, the slogan should be: "The light on the road, and not in the eye." He thought this would sum-up fairly well what Mr. Harrison had been telling them in a highly scientific way. The paper they had just listened to, taken in conjunction with the standard clauses of the street lighting specification of the Illuminating Engineering Society, 1913, and Mr. Abady's paper on "Public Lighting" read before the Institution of Gas Engineers at an earlier date, might form a classic upon this subject. The last speaker had pointed out the effect of light upon the eye. It was through the eye that impressions of a lighted space or interior were received. The retina had the power of adapting itself to light and darkness in a wonderful manner; the pupil aperture acting as a safeguard. In comparative darkness, it opened itself to its fullest extent to admit as much light as possible, and contracted in proportion to the brilliancy, so as to shut-out the excess. Partly by the alteration of the pupil aperture, and partly by changes in the retina, the eye could adapt itself to wide variations in illumination; but this took time, and was only possible within certain limits. If exposed to very sudden contrasts in brightness, so great that the eye could not protect itself, then it was bound to suffer. The eye also needed a steady light. If the illumination was changing and flickering, the eyes endeavouring to adapt themselves to the changes suffered fatigue. No brilliant unshaded source of light should be in the direct range of vision, or the eye was dazzled. Its efforts to adapt itself to the brightness made moderately illuminated surfaces in the neighbourhood appear dark by comparison. After looking at this bright source for a short time, and transferring the gaze to a relatively dark background, one saw a bright after-image—proving that the eye was fatigued, and did not resume normal conditions for a little while. This was what the authors rightly called glare. The lighting of roads and streets should be so graded that one was not at one moment in a good field of light and at the next in relative darkness, long before the eye could accommodate itself—as by stepping from a well-lighted road into one badly lighted, or a boundary road between two council's areas, the footpath on one side of which had a line of powerful flame arcs on standards fairly close together, while the footway on the other side had a few small gas-lamps placed widely apart. Imagine the torture to the eyes of the wayfarers using such thoroughfares. This was not a supposition. There were some main roads and areas in the Metropolis which were much over-lighted, and others much under-lighted—both of which constituted bad lighting. The over-lighted road served to cause trouble in the immediately surrounding streets. He had in mind Oxford Street, which was lighted by powerful flame arc lamps down the centre of the carriage way. On each refuge stood a lamp standard; and from a cross-piece at the top were suspended two lamps. The rests were fairly close together, through the whole length of the thoroughfare. One night a carriage that had been driven from Oxford Street into one of the squares leading from it, collided with the iron railings surrounding the garden, and was smashed. An action was brought; it being argued the square was insufficiently lighted. Thus it became necessary to inspect the place at night; and it was proved that the square was well lighted. But approaching from Oxford Street, the driver's eye had not time to accommodate itself to the sudden change of conditions. Had the driver approached the square from the other end, it would have been quite safe. Oxford Street might be lighted in a spectacular manner; but it was not illuminated. It was just an instance of glare. Again, he did not consider the Lewisham High Road parade lighting a good piece of lighting in a main road used by omnibuses and trams—namely, high-pressure gas-lamps on standards only a few feet apart for a considerable distance. This was tradesmen's lighting; but the light was there for all who wished to use it. He felt sorry for the drivers and pedestrians entering and leaving this section. On the new Southwark Bridge, the lighting-points were so close together that, looking north or south, one "could not see the wood for trees"—or the bridge for lamp standards. They were but 15 yards apart; and each point had a cluster of three lamps. They were not staggered, as in ordinary lighting, but were opposite each other on a roadway only 45 ft. wide. It was magnificent as a display; but financial ability, in these days, was the test for the public lighting of roads, as in other matters; and were they to go over Southwark Bridge now, they would only find one-third of the lighting—the Corporation having wisely extinguished two lamps out of each group of three. As to the position of lights, he was now in charge of a system in the City of London (the installing of which he had supervised) of high and low pressure gas and electric flame arc lamps centrally suspended across the road from the house-fronts in all the principal thoroughfares where practicable. Care was taken at junctions to suspend the lamps so that the light should illuminate each of the four streets—by the aid of special dioptric lenses in the case of the electric, and good reflectors for the high-power gas-lamps. Thus not only was the main road efficiently illuminated, but it enabled all the smaller units of light in the side streets to be extinguished within 50 yards or more of the light sources. As the illumination down the side streets gradually died-away, it was taken-up by small units, so preventing any walking into darkness, as in the square off Oxford Street, and obviating sharp dark lines across the openings of side turnings. Each lamp was fitted with a special lowering gear and lamp attachment on the wire, with the necessary switches and cocks on the wall. The lamps were suspended 27 ft. 6 in. above the centre of the roadway, on an average of about 150 ft. apart. This, with the special lenses and reflectors, gave an even illumination along the road; there being no shadow. With a generous number of small lamps in the side streets, the City of London at nights—except in some of the courts—was shadowless. Where it was not possible to put up suspension lamps, he had placed the lamps on posts with swan-necks 24 ft. 6 in. in height from the top of the swan neck to the pavement, and 18 ft. from the pavement to the underside of the globes in streets of 40 ft. in width. The lamps had a light source of 2000 c.p. In roads of 100 ft. width, there were tall ornamental columns 25 ft. 6 in. high, with a light source of 4000 c.p., 175 ft. apart, each column fitted with lowering gear to bring the lamp down for trimming, &c. The lamps centrally suspended in Cheapside and the Poultry were of 3000 c.p. light source each. They had a very pleasing effect—being sufficiently high up not to affect the eye. This Cheapside lighting was a trifle spectacular, though without glare, and was decided upon on account of its being a shopping thoroughfare. Arrangements were made to extinguish every other lamp at midnight—a most economical plan, which had since been extended to the whole of the City. The lamps in the side streets were on brackets about 11 ft. 6 in. in height fixed on the house-fronts, so as to keep the pavements free for the enormous pedestrian traffic. The Corporation had special powers in this question of affixing brackets to house-fronts. The high-pressure lamps on brackets were over 20 ft. up, to come into line with the centrally suspended lamps as far as possible. The brackets extended across the whole width of the footway, to the kerb line. By this method of lighting the City, a sum of no less than £6800 per annum was saved by the public authority, while the illumination was increased by 600,000 candles—practically 100 p.ct. on the old lighting—in spite of nearly a thousand small lamp units being extinguished in the minor streets. Every existing lamp was scrapped, and modern ones installed. Thus, if the matter was looked at scientifically, one need not be afraid to scrap old systems, and put up new ones, because they would more than pay for themselves.

Mr. C. WATSON (Deptford) remarked that, until the last speaker alluded to the reduction of the lighting on Southwark Bridge, he had intended to congratulate the authorities upon having evolved an ideal system of lighting, in that the illumination was thrown over the whole area of the bridge, without any shadow being caused. Having had considerable experience of accidents through shadows caused by lighting, he could say that such shadows were the greatest terror of the drivers of mechanically-propelled vehicles. If they could get a uniform system of lighting which threw no shadow over the whole area, and a gentle graduation from main roads into side streets, many accidents would be avoided. It had been said that the eye could accommodate itself to different forms of lighting. In a given time, it might; but he wanted to say from practical experience, and with all due respect to the expert's view, that what really happened when a man who was driving a fast vehicle passed from a brilliantly lighted thoroughfare into a comparatively dark one, was that he was momentarily blinded. It was only by shutting and then opening again that the eye could accommodate itself to the change; but an accident would take place in far less than the time necessary for this. All lighting should be carefully graduated from the main thoroughfares into the roads leading from them. Many accidents were caused through experimental systems of lighting. A friend of his had been killed near a flame arc lamp which had a brilliant halo of light round it, with pitch darkness outside this circle. The object of bright lighting was to facilitate traffic and conserve human life by preventing accidents; and therefore what was wanted was the best system of illumination that it was possible to get. While glare was undesirable, a driver must be able to see where he was going.

Mr. T. BLAGBURN (Hale) asked for some further information upon the subjects of controllers and the use of superheaters. The point about lighting was to get continuous illumination of as uniform a character as possible.

Mr. LEON GASTER declared that the paper was a very timely one; but what he wished particularly to thank the authors for was their reference to the illuminating engineering movement. He was glad to say that the subject of lighting had now taken its proper place. As to nomenclature and definitions, of course, people did not all speak English; and so it was necessary to compromise. It was gratifying to know that, after many meetings in London and several in Paris, they had agreed to three terms which were now properly defined, and there would be no difficulty in understanding them on either side of the water. These were the fundamental ones; but there were more, of course, to come. They must realize that now the conditions imposed upon lighting were not the same as thirty years ago. The whole trouble arose from the old lighting systems which were still in existence. Improvements had been made in some directions. He had taken a friend from New York to inspect the lighting of the Corporation of London; and this gentleman had been surprised and very pleased to see the uniformity and enormous amount of good lighting in the City. There were, however, many other parts of London which left much to be desired. It was one of his privileges, in connection with the Safety Council, to advise as far as possible uniform illumination. Glare was not so troublesome in itself as the contrast. To make a good road for traffic, it was absolutely essential to have it evenly lighted; or if it could not be even, to make the transitions as gradual as possible. As Secretary of the Illuminating Engineering Society, he had many visitors to show round London; and they could not understand why there might be one method of lighting in a main street and another method in a thoroughfare close by. If in time of war they could be put under one authority, why not in time of peace have one authority to tell them what the lighting of London ought to be? He did not say to do the work, but to give them a specification. If they had an authority to determine what the lighting ought to be for main roads, and second, third, and fourth roads, and then so arranged that every district should conform to these requirements, the lighting of London would be different from what it was at present.

Mr. J. S. DOW remarked that he was glad these matters were being studied, and would like to say a word or two about the units. It was stated in the paper: "Such confusion prevails in this connection that even from standard works on the subject no clear conception can be derived of the significance of these various units." Well, this was a hard saying; but, as had been pointed out, there were different illuminations and different systems of lighting in various countries to consider. And he noticed, too, that the authors themselves, after referring to the existing complexity, proposed another unit—the "Murdoch"—to take the place of the foot-candle. So that they also had their little preference for different kinds of units. A very interesting point in connection with the measurement of the candle power and the specification of the illuminating power of lamps seemed to him to be raised by the table in the paper which expressed the values alternatively in candle power per cubic foot and candle power per one-hundredth of a therm. This idea was somewhat in accordance with what the American Society proposed—expressing values in candle power of English thermal units per hour. This was no doubt a logical step;

but the paper gave them food for thought and discussion here. If these two systems were to be run simultaneously, was it likely that in different districts, with values expressed in cubic feet and in therms, anything like consistent results would be obtained? He noticed that even with the particular lamps mentioned in the paper—which he presumed were all in the South Metropolitan Company's district—if they followed down the columns the ratios were not quite the same; and if they were dealing with all sorts of districts where there were different qualities of gas, there might be even greater variation in the results by the two methods. With regard to the question of glare, he thought that, if anything, the authors had under-stated its importance. The vital thing in street lighting was so to conduct it as to avoid any great intrinsic brilliancy. The crying need was to avoid sharp contrasts; and to this end it would be advisable to encourage in streets, as far as one could, private illumination by signs and bracket lights, so as to produce greater uniformity of illumination. In the various districts of London, private lighting could be more developed—on the understanding, however, that all this private lighting must be effectively screened. One step in this direction was what was called parade lighting, of which there were some examples in the South Metropolitan Company's district, and which was most valuable, if the light was softened by diffusing globes. He thought the American plan of using clusters of lamps in obscuring globes was one that would be seen more of in this country. Of course, they had seen the introduction of "Vitreosil" globes; and the fact that apparently this silica stuff could not be made completely transparent was most fortunate. To his mind, there was no comparison between a lamp with a globe of this kind and a naked light. The effect with the globe was infinitely better; and he felt sure that in the future the tendency would be more and more towards the use of these softened units. He would like to ask Dr. Thomas whether he could confirm the statement that in public lighting it was now an accepted fact that when cluster units were used the maintenance of the larger number of mantles was actually less than when only one or two big mantles were employed. There was no doubt, he imagined, that the efficiency of the method was better; but was the actual cost of upkeep less?

Mr. J. G. CLARK (Gas Light and Coke Company) remarked that there was not very much time left for discussion, so he would make his remarks as brief as possible, and try not to traverse ground already covered. Public lighting seemed to be becoming more important every day. It sometimes seemed as though the volume and speed of the motor traffic about London was even greater during lighting hours than in other parts of the day. He noticed the paper suggested a new name—the Murdoch—for the unit of illumination. He (the speaker) recalled having made a somewhat similar suggestion some years ago; but the time was not ripe for it then, and he was promptly "sat upon." However, he was rather in favour, wherever possible, of utilizing these units as a means of commemorating some of the workers in the industry. In this respect, they had lost an opportunity with regard to the therm, which he would have liked to see given a name that would have perpetuated the work of one of their great men. Perhaps it was not too late for it even now. They might have a name for the unit equal to one-hundredth part of a therm. The authors used this unit in their paper; and it was a very useful figure. It was equal to about 2 c.ft. of gas, roughly; and it might very well be given a name in the manner which the authors had in mind. He agreed with what was said in the paper as to candle power being the best means of measuring the value of light sources. Of course, the ultimate object of all light sources was to produce illumination; and the value of the source had to be judged by the illumination that was produced. But it was one thing to talk about the production of illumination, and another thing to measure it. There were now in the different branches of the lighting industry a lot of statistics in which candle power values, distances of lamps, heights, and so on, were correlated very closely with the illumination; and it ought to be the business of somebody very soon to collect all this data, so that there might be in front of them a schedule of values where candle power and illumination were correlated. This would be of great assistance in arranging the lighting of streets. Though illumination was what they wanted, candle power was the best means of measuring it. He was connected with some big lighting contracts; and the question of the measurement of light had become very important indeed. Lamps had to be tested regularly in order to conform with the specification; and he would like to say they had found in practice that the measurement of the candle power was a very satisfactory means of doing the work. To this extent the views of the authors were confirmed. Of course, it was important, when speaking of candle power, to know what angle was being referred to; and this ought, perhaps, to be better known among people who had to arrange lighting. The mere mention of candle power was not enough fully to describe a lamp. In the contracts he had in mind of the Company he was connected with, more than one angle was specified, and the candle power was prescribed and measured at these angles; so that they knew just what they meant when they talked about the candle power of a lamp. He was rather surprised that the question of centrally suspended lamps had not been touched upon more that morning. These were used in certain parts of London where there existed two conditions which seemed to point to this system of lighting being the only expedient way of doing it. The conditions were where streets were narrow and the traffic was very heavy. It was a rather important aspect of public lighting. Another important question was that of maintenance. The amount of light obtained from a gas-burner was greatly dependent upon the maintenance; and what he would, as the result of a very extensive experience, like to suggest was that, where local authorities had to arrange contracts for lighting, they would be wise to consider whether it would pay to put the maintenance of the lamps in the hands of the gas companies, who, by virtue of their business, gained a very wide and valuable experience. Generally speaking, it would be found that lamps maintained by gas companies were a little better than those maintained in some other way. This was not intended as a reflection on maintenance as provided by local authorities.

Dr. THOMAS, in reply, said he was glad to hear that Mr. Haydn Harrison had fought against the introduction of the lumen; and he (the speaker) also wished that he had been successful. He did not, however, think that the time for fighting was yet passed. If illuminating engineers got the lumen into circulation as an accepted unit, they would, he was certain, regret it. In specifying or drawing-up the characteristics of any kind of illumination, one should get to the bed-rock principle; and they of the South Metropolitan Gas Company contended that the candle power of the source was a very much more fundamental thing than the luminous flux. The late Lord Rayleigh himself was not convinced of the necessity of introducing anything more than candle power into illuminating engineering. They would find in a back number of the "Illuminating Engineer"—and he would here pay a tribute to the work which the Illuminating Engineering Society had done in advancing that branch of engineering—a remark by Lord Rayleigh to the effect that he was not convinced that the idea of flux must be introduced into this science; and he rather was against the idea of this multiplicity of units. He concluded with the remark that "the discussion of these things is now becoming so difficult that it is even hard for those who laid the foundation of the subjects to understand them clearly." They must guard against all over-elaborate nomenclature. As to Mr. Liberty's remarks, they had succeeded on the new Southwark Bridge in obtaining a very uniform system of illumination. It was pointed out in the paper that the question of cost was the very *crux* of the matter; but the lighting of Southwark Bridge did show that it was possible, cost apart, to produce a system of street illumination which would satisfy the most drastic requirements of traffic people. It was desirable that traffic experts and street lighting experts should discuss their views together. Replying to the question about automatic controllers, he might say that the South Metropolitan Company had a number under test; but they were not yet in a position to express an opinion as to their efficiency or otherwise. Mr. Blagburn could rest assured that there was a tremendous increase in efficiency by the use of superheaters. He had really suggested the name Murdoch (though he knew that in doing so he would be multiplying the large number already in use), because he felt that if they introduced such names as these into illuminating engineering, people would understand much more clearly what was referred to than by using some of these long words. The therm per hour was a thing which certainly wanted a name. The electricians had it in the watt. As to the lower cost of maintenance of cluster units, there certainly was a very much reduced cost, arising largely from the saving in glassware, which he believed accounted for about half the cost of maintenance of street burners. If there were any other points requiring elucidation, he would reply in writing.

On the proposition of the CHAIRMAN, the authors were heartily thanked for their paper.

UTILITY OF BENZOLE FOR TRANSPORT PURPOSES.

By Capt. E. DE NORMANVILLE.

Benzole for motor spirit is the fuel distilled from coal, or washed from gas production, which, after the refining treatment, conforms to the standard specification of the National Benzole Association. In arranging this specification, the Association have made the purity demands the minimum compatible with successful use. A fuel warranting the chemical or commercial name benzole, but at the same time not coming up to the standard specification, might have a deleterious effect on the running of an engine. Therefore, in speaking of benzole for use as motor spirit, I mean only that fuel which conforms to the "N.B.A." specification. The vast majority of the large benzole producers are members of the "N.B.A.," banded together for their mutual interests and for the further development of the home industry; but there are still some who remain outside, for reasons which are no doubt excellent from their point of view. The development of home-produced fuel possibilities is, however, a matter of such vital importance to the nation, that one would like to see complete unity of all those able to assist.

ADVANTAGES TABULATED.

The practical advantages of benzole may now be tabulated: (*a*) More power; (*b*) increased mileage; (*c*) no pinking; (*d*) economy of use; (*e*) "sweeter" running; (*f*) home production. In the face of so many valuable advantages, one is not afraid to record what the opponents of benzole have stated to be disadvantages. The alleged disadvantages are: (*a*) Higher freezing-point than petrol; (*b*) lower volatility; (*c*) stronger solvent than petrol. The greatest of these is the last.

To the charge of benzole being a stronger solvent than petrol, one must plead guilty; but forewarned is forearmed, and it is only necessary to take reasonable care so as to avoid spilling. The whole of my practical experience with benzole since the introduction of the standard specification—in excess of 22,400 miles—reveals absolutely no difficulty of a practical nature, other than the need of care in avoiding carelessness when taking supplies on board.

To find the actual difference between the laboratory freezing-point and the practical car-tank freezing-point, is an investigation which someone should undertake. But the standard specification of the N.B.A. specifies a freezing-point not above 7° Fahr.; and as in practice benzole does not freeze until a lower temperature than that assigned to it in the laboratory, ample provision is ensured for the elimination of freezing troubles under all normal weather conditions in this country. This is achieved by the addition during manufacture of from 10 to 20 p.ct. of toluole. There is nothing to be afraid of in regard to toluole, as in itself it is quite a good motor spirit, and is, like benzole, highly rectified.

We now come to the question of volatility. Here, again, the

laboratory enthusiast has a snag up-against benzole by comparison with the better-grade petrols. But we are concerned with practical facts; and among these is the compression heat engendered by the engine, which ensures such a measure of volatility that no difficulty is encountered. We had a few cold spells last year; but I never encountered any difficulty in starting-up from cold. Unfortunately the supply of benzole is a limited quantity; and most motorists have to be content with half and half, or even a third part of benzole. In such circumstances, the low volatility bogey recedes still further from the realms of practical politics.

We now turn to the more practical topic of the advantages of benzole. In these days of high taxation, the power and mileage of the fuel used are vital aspects of practical economy. The different brands of petrol vary considerably in their mileage and power attributes—and vary mainly on account of the different percentages of benzole in the fuels. The more the benzole content, the better the fuel. Obviously, therefore, we can look for more power and mileage in benzole—an advantage which is now universally admitted. There is about 20 p.ct. more thermal energy per gallon.

THE ECONOMIC FACTOR.

At the present time the retail cost of benzole is about 20 p.ct. more than that of petrol, so that with a 20 p.ct. better mileage the two fuels are about equal on the mileage basis. But that is not the only factor. With a concurrent increase of power, the total value of the practical saving would be more than 20 p.ct. In trials by comparison, figures that are considerably in excess of the theoretic advantage have been encountered in the course of our practice.

But there are other economic factors. The general wear and tear of the engine and chassis are less when benzole is used. The elimination of "pinking" itself is a valuable factor in this respect, as minor degrees of knocking frequently pass unnoticed by an average driver, though such detonation is ill-effecting the life of the engine. Then again, with regard to carbonization, though one is not justified at the moment in saying that it is less with benzole than with petrol, it is certain that, with a given amount of carbonization for each fuel, that with benzole is less harmful. It is also more readily removed. Here, again, there is scope for interesting research work, though it would be difficult to arrive at a definite conclusion, as varying lubricants would probably be needed to obtain the best results with each fuel. This brings me to another important point in regard to the utility of benzole.

PROPER LUBRICATION.

To obtain the best results from the use of benzole or benzole mixtures, you must use a suitable lubricant. At the least, you must use a high-grade mineral base oil, as animal or vegetable compound oils are not suitable unless one is prepared to change to a fresh supply more frequently. The reason is that, by some action not yet fully known, benzole vapours tend to accelerate sedimentation. As a matter of fact, all lubricating oils undergo a chemical and physical change when exposed to high temperatures, resulting in sedimentation. The rate of the formation of sediment, however, differs greatly between oils of good and of poor quality when used under similar conditions. Ideal lubrication necessitates the use of an oil of just the right consistency to act as a cushion between all moving metal parts when the engine is running. It is also equally important that the oil should form a gas-tight joint between the piston-rings and the upper walls of the cylinder, to prevent the escape of exploded gas.

The ideal oil is that which is of sufficiently high flash-point to perform its work under the highest temperatures, of the correct viscosity to avoid a break in the film without forming sediment in the crank-case, and also to operate effectively at a low temperature without getting sticky. It is also of vital importance that the oil should enter the circulating pump freely when starting an engine from cold. The National Benzole Company, Ltd., have recently placed an oil on the market specially prepared to meet all the requirements of correct lubrication when benzole or benzole mixtures are being used.

PRODUCTION POSSIBILITIES.

The final advantage enumerated on behalf of benzole is the fact that it is home-produced. The value of this fact was of paramount importance in the war, and would, of course, be of equal value in any future war; but there is another aspect of the question. Our great oil experts differ as to the available supplies of petroleum. So far as we now know, benzole is our only practical and commercial home-produced fuel possibility. It comes mainly from two sources—the coke-oven plant and gas scrubbing or washing. At the present moment, the output from each source is not so good as it might be. Motorists grumble, and say, "Where is the benzole?" The answer is simple, "It isn't anywhere"—that is to say, by comparison with what the output was, and later will be. The trouble was the coal strike and the industrial situation. When industry is bad, the demand for steel is small; and therefore there is little call for metallurgical coke. At the time of writing, of the 303 blast-furnaces working in 1920, only 47 were operating. Of the 9500 odd coke bye-product ovens, less than 3000 were working. A similar falling-off in supplies from gas-scrubbing obtained, though from different causes. But the sum total of the then situation was that not much more than 25 p.ct. of the 1920 rate of benzole output was available. With a pick-up in industrial activity the output of benzole from coke-oven plants will increase, as it is already doing, week by week.

With regard to the supplies from gas-works, I am afraid it is purely a question of economics. The gas industry no doubt appreciates the desirability of increasing the supply of benzole by washing the gas; but it cannot do so unless the work is economically practicable. That is to say, it is not equitable to expect the gas consumer to pay more for his gas in order that there may be more benzole for motorists. It is a regrettable fact that this is the present position. If we assume that crude benzole contains 127,000 B.Th.U., then, with the price now being obtained for gas—say 14d. per therm—the same number of British thermal units in the form of gas would represent about 1s. 6d. Unless, therefore, the price obtained for these heat units in the form of benzole is such as to provide a net revenue of 1s. 6d., after deducting all the costs of recovery, including the charges on the plant, it is obviously not a commercial proposition for a gas undertaking to recover benzole. If benzole is washed out from the gas, it is necessary to add about 2¾ gallons of gas oil to make good the calorific value of the stripped gas. We must look, therefore, for cheaper gas oil and washing acids, before we can reasonably expect a material increase in the output of benzole from gas undertakings.

LOOKING AHEAD.

If one endeavours to search the future in regard to benzole output, it is necessary to be circumspect. If eventually circumstances should make it practicable for all large gas undertakings to recover benzole, we could anticipate possibly 25,000,000 gallons per annum from such sources. In this estimate I assume economic practicability in undertakings with an annual gas production of 75,000,000 c.ft. upwards, which would represent some 300 undertakings. Beyond this there will be—granted good trading conditions generally—the heavier output from the coke-oven plants, which, when all are suitably equipped for benzole recovery, might mean about 30,000,000 gallons per annum. These estimates are what I term reasonable future possibilities. They are dependent on economic factors of probable materialization and the time involved in development. Thus one is warranted in saying that there are reasonable possibilities of gradual development in benzole production up to some 50,000,000 or 55,000,000 gallons per annum, though naturally this development will take many years to fructify to the full.

Beyond this I go into the land of dreams. What I have so far enumerated only concerns some 15 p.ct. of the total coal consumed annually in this country. The vast bulk—85 p.ct.—is not distilled at all, but is used as mined; and the benzole goes up the chimney. It is probable that in our children's lifetime nearer 90 p.ct. of our coal will be distilled before use. So, in the land of dreams, I leave you to work out the ultimate utility of benzole—in gallons per annum—for yourselves.

DISCUSSION.

Mr. H. W. JAMES (South Metropolitan Gas Company) said the author had laid emphasis on a very important point—the purity of the benzole. But he was carrying his argument a little too far when he said that, if one did not use benzole up to the specification of the National Benzole Association, one would get into trouble. For many years, he (the speaker) had had charge of the manufacture of motor benzole on a large scale. They had made no attempt to conform with this specification; but their customers were universally satisfied. It was unfair to condemn all makes of benzole that did not conform with this specification, though it was no doubt true that, if one used the benzole to which the author referred, one probably would not have any trouble. The specification was of such a nature that it excluded toluole, which was used by itself as a motor spirit, without any benzole in it. He would suggest that the specification might be considerably widened, so as to include more toluole. In fact, solvent naphtha had been used satisfactorily on motor bicycles. The specification might therefore be altered to include some of these spirits.

Mr. E. HAZZARD HARMAN, referring to the future output of benzole, pointed out that the effect of steaming in the manufacture of gas would have to be considered in this connection. They were going to make a great deal more gas with less coal, and this was cutting-out a certain amount of what was obtained apart from steaming. Recently he had been in touch with a number of small works; and from one they were sending out gas of 650 B.Th.U. There was a gas asking to be stripped. They sold their tar to anybody who would take it away, because transport cost so much that they got very little if they sent it to the distillers. It occurred to him that, a little later on, when things became more normal, they might be able to go into the question of those works where they were making a gas altogether too good for the ordinary demands of the public. This might ultimately be washed, so as to afford a little assistance in increasing the output of benzole.

Captain DE NORMANVILLE, in reply, remarked that he did not say one must not use any benzole except the National Benzole Association's. He had nothing to do with the Association, or with any benzole producer. What he did say was that it should be up to this specification, in order to be quite sure of what was going to happen. Very extended experience had shown him that an inferior quality of benzole was a risky thing. Therefore he urged that, by using a quality which was a known factor, one was safe; or, of course, one might purchase from a firm whose name was a sufficient guarantee. He agreed with the remarks about toluole. He used it himself; and it made a very excellent spirit. Anything which would increase the total quantity of benzole or benzole mixed with toluole would be to the general advantage.

The CHAIRMAN, in proposing a vote of thanks to the author, said he believed that one gas undertaking at any rate which had given up benzole washing was returning to it. This might be taken as an indication of the trend of events.

THE EXHIBITION.

The last Roads and Transport and Public Works Congress and Exhibition, which was held in 1919, proved so successful that it was decided to repeat periodically the opportunity for members and officials of local authorities, together with manufacturers, to meet and discuss with one another questions bearing on the means of developing and improving the services on which the health and well-being of the community depend.

The inaugural luncheon of the present congress and exhibition (which remains open till Friday, the 25th inst.) took place at the Holborn Restaurant last Thursday; numerous representatives of public bodies and of technical societies associated with their work being present. Sir Henry P. Maybury, K.C.M.G., C.B. (Chairman of the Congress Organizing Committee), presided. Among those present were Mr. Thomas Hardie (the President of the Institution of Gas Engineers) and Mr. Walter T. Dunn (Secretary). After the Loyal Toasts had been observed, "His Majesty's Government" was proposed by Sir W. Ryland Adkins, who said that public utility undertakings supplying gas, water, and electricity were carrying out most important services. He understood that the exhibition in connection with the congress contained much that was of interest to the members and officials of these bodies. The only other toast submitted was that of "The Chairman." The proposer, in the course of his remarks, alluded to the high place which Sir Henry Maybury had won for himself in the estimation of the many members and officials of local government authorities, by his considerate attitude and regard for the peculiar circumstances of the bodies he was brought into contact with.

Subsequently the exhibition was opened by Mr. Arthur Neal, M.P. (Parliamentary Secretary to the Ministry of Transport), who spoke of the importance of the objects the organizers had in view. That they had succeeded in their endeavours to obtain a good representative assembly of machinery and plant, would be apparent from the fine collection of exhibits. Those members present then occupied themselves in an inspection of the exhibits, of which there were about 150.

Of special interest to gas engineers are the stands of Messrs. John Yates and Co., of Birmingham, who had included in their exhibit various descriptions of tools used in gas-works; the steam wagons of Messrs. Mann's Patent Steam Cart and Wagon Company, and those of the Yorkshire Commercial Motor Company, of Hunslet, Leeds; and of the Sentinel Wagon Works (1920), Ltd., of 14-16, Grosvenor Gardens, London; the exhibit of gas-works plant by Messrs. G. Trentham, Ltd., of Birmingham; "Tarmac" produced by the Company of that name at Ettingshall, Birmingham, and made from selected blast-furnace slag; National benzole in its various stages of production, and "N.B.C." lubricating oils; and "Cuirass" anti-corrosive paint made by Cuirass Products, Ltd., of 69, Victoria Street, S.W.

The Torbay Paint Company also have an interesting exhibit. Messrs. Parkinson and W. and B. Cowan, Ltd., of Bell Barn Road, Birmingham, have a very attractive show, consisting of examples of their latest designs of lanterns and requisites for public lighting, including their series of high candle-power preheated inverted gas-burner lamps, with outside gas and air adjustment, suitable for main thoroughfares. They are also showing a series of preheated inverted burner conversion sets, upright inverted cluster burners, acetylene torches, and service cleaners, besides cast-iron lamp columns, wrought-iron frogs, swan-necks, harps, &c. The Staveley Coal and Iron Company's exhibit consists of specimens of their well-known cast-iron pipes for gas and other purposes; while Messrs. Stewarts & Lloyds, Ltd., show welded mild steel gas and other pipes with joints of the spigot and faucet, screwed, and flange types. Black and galvanized gas tubes and fittings are also included.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

Annual General Meeting in Birmingham.

THE Annual General Meeting of the Midland Association of Gas Engineers and Managers was held at the Grand Hotel, Birmingham, on Thursday last, Nov. 17. Mr. JAMES PATERSON, M.A., of Cheltenham, presided over a large and representative attendance.

NEW OFFICERS.

The first business was the election of officers for the ensuing year.

The PRESIDENT stated that no nominations had been received; and, in accordance with their usual procedure, the Committee recommended the following gentlemen for the various offices:

President: Mr. W. H. Adams (Bilston).
Vice-President: Mr. P. N. Langford (Coventry).
Committee (ordinary vacancies): Mr. F. C. Briggs (Dudley), Mr. F. Key (Lichfield), and Mr. G. B. Fiddes (Leicester); and Mr. E. L. Adlington (Worcester) to the vacancy on the appointment of Mr. Langford as Vice-President.
Auditors: Mr. J. W. Allin (West Bromwich) and Mr. E. B. Tomlinson (Birmingham).
Hon. Treasurer: Mr. W. R. Cooper (Banbury).
Hon. Secretary: Mr. T. Thornton (Rowley Regis).

The PRESIDENT, in proposing the election of Mr. Adams as President, observed that as Vice-President he had been a source of great help to him in his office. His qualifications for next year's position were well known to them, and he believed he would carry out the duties admirably.

Mr. B. W. SMITH (Walsall) seconded the resolution, which was carried unanimously.

Mr. ADAMS, in acknowledgment, stated that he was delighted to accede to their request to accept the position of President. He recognized that it would be extremely difficult to follow a gentleman like Mr. Paterson; but his endeavour would be to uphold the traditions of the office to the best of his ability.

The PRESIDENT, in moving a resolution confirming the Committee's recommendations in relation to the other appointments, said he thought they had made a wise selection, which would meet with general approval. He wished, specially, to express his appreciation of the work of Mr. Thornton as Hon. Secretary. It was not an easy matter to follow their late Secretary, who held the position with distinction for a number of years; but Mr. Thornton had risen admirably to the occasion, and had proved an excellent Secretary. He was quite sure he would be very helpful to the new President and the members generally.

Mr. J. FERGUSON BELL (Derby) seconded, and expressed his satisfaction that Mr. Thornton had agreed again to act.

The resolution was unanimously approved.

AN EMERGENCY FUND.

The next item on the agenda was the consideration of a suggestion for the formation of a Benevolent Fund.

The PRESIDENT said when the suggestion was first made he was doubtful as to the necessity (leaving out the question of expediency) of forming a Benevolent Fund in the Association; but on further considering the matter, he had modified his view. In the Midland district there had, from time to time, been sad cases of distress or of premature or sudden death or disablement. As members, they had done what they could by making a collection, and so far as it went the result was satisfactory; but it was felt that a case might arise in which it would not be possible to give assistance with desirable, or absolutely necessary, expedition. As they knew, the Benevolent Fund of the Gas Institution took care of cases requiring assistance; but, for a variety of reasons, the wheels of charitable effort might move slowly. The delay occurring sometimes was possibly unavoidable—certainly not intentional; and the object of the proposed fund was to give, in such cases, a little prompt assistance. In the words of the old Latin tag—to give quickly meant in a way to give twice over; and this was the essence of the suggestion to be submitted to them by Mr. Pooley. But he (Mr. Paterson) wished it to be perfectly understood that there was no suggestion to duplicate funds for benevolence. It was really a supplementary fund, which could be used, and would be used, for affording immediate relief when this was necessary. At the present time no scheme had been formulated; but this would be done with the approval of the members.

A letter was then read from Mr. Fred North enclosing a cheque for £100 to the Benevolent Fund of the Institution of Gas Engineers (the parent body), and adding: "I do this bearing in mind the happy association of my late father with the Midland Association and the Institution of Gas Engineers in memory of Mr. William North." Such an action, added Mr. Paterson, brought its own reward.

Mr. HUBERT POOLEY (Leicester) said he had had on his mind for a long time this question of the provision of a fund from which prompt assistance might be given in cases of need. He was on the Committee of the North British Association when the Benevolent Fund was started; and there was, he recalled, some opposition to its formation. But the opposition was successfully overcome. The subscription to the fund was fixed at 2s. 6d., which meant the raising of the original subscription from 10s. to 12s. 6d. The subscription figure remained until a few years ago, when it was advanced; but the contribution to the Benevolent Fund remained unaltered. The fund had helped a great many necessitous cases in Scotland. The object of the proposed fund in the Midland Association was to give relief speedily; and then the case could later be dealt with from the Benevolent Fund of the Institution of Gas Engineers. There had been two sad cases in the Midlands—a disablement case, and the case of a widow. Contributions were gladly given by members. Some members were not asked to give; but, if they had been, he knew there would have been a good response. He hoped he had said sufficient to show the need of making some provision in addition to the Benevolent Fund which really provided more for the future, and in a way they could not possibly do in a district body. He had not seen the recent accounts of the North British Benevolent Fund; but he had observed that

for the twenty years (1896—1916) £586 was accumulated. With a much smaller membership, their Association could not, of course, hope to do anything like this; but still it should be possible to establish an effective little fund. His idea was that their annual subscription should be definitely increased by 2s. 6d., to be earmarked for benevolent purposes on the lines indicated. He moved a resolution authorizing the Commiitee to prepare a scheme to be submitted later for consideration, and he hoped approval.

Mr. W. WILSON (Burton-on-Trent) seconded the resolution. He observed that, as a Past-President of the North British Association, he was able to say that the charitable work referred to was invaluable in cases of distress. The help given was a source of great joy and comfort. In Scotland, there were many professional men engaged in the gas industry who were not members of the Institution of Gas Engineers—many of them were engaged on small undertakings—and, in case of bereavement, help was fairly frequently needed. In drawing-up a scheme, care should be taken to clearly state what any additional subscription would be used for, because he recalled one instance in Scotland where a member objected to pay the Benevolent Fund subscription, stating that he preferred to do "good by stealth." Personally, he looked at the matter in a broader way.

The PRESIDENT desired emphatically to state as their representative on the Committee of the Institution of Gas Engineers and on the Committee of its Benevolent Fund, that the proposed fund was not to be, in any sense, a rival of that fund, but merely to supplement it, on the principle of giving relief in the early stages of cases of distress needing such help.

Mr. BELL said he recalled three cases in which the members responded adequately to urgent calls for aid, to cover the intervening period from the making of an application to the central fund to the time when a grant was made. The assistance given from the fund had been alike liberal and adequate; and but for it, it would not have been possible for orphan children to be brought up as members would desire. He hoped every member of the Midland Association would make a point of subscribing.

Mr. J. R. DUFF (Banbury): Would a grant from this local fund, if it is established, interfere in any way with relief being given from the major fund to a distressed member, or to a widow of a member?

The PRESIDENT: We must be careful to avoid any such interference. I think it can be safeguarded.

Mr. F. NORTH (Stourbridge): I think the title "Emergency Fund" would be preferable to "Benevolent Fund."

The PRESIDENT: I think perhaps it would.

Mr. W. C. GOODCHILD (Derby) observed that at a previous meeting there was reference to the advisability of having a subscription that would cover the cost of "The Proceedings." If there were to be any alteration in the subscription, would it not be well to consider it in the light of the two purposes—a subscription for charity, and a sum for providing a book of the proceedings?

The PRESIDENT stated that, with regard to this matter, consideration had been given, and they had had a conference with the former publisher of the book. They had not, however, been able to come to any arrangement; the difficulties seemed insuperable at the present time. This was a matter that the Committee must look into again; but they had no suggestion to make, for the reason that the cost appeared to be prohibitive. They must have a guaranteed circulation for the book, and guarantee the size of the volume. But who could do this in these days? There might be a big meeting in other parts; and the effect would be greatly to increase the size of the book, and so one could not have a fixed sum to meet this.

Mr. B. W. SMITH (Walsall) said the 2s. 6d. contribution suggested for the Emergency Fund would not go very far unless there was a nucleus of a fund formed, and he would be glad to subscribe a guinea for this purpose.

Mr. BELL and Mr. GEORGE HELPS (Nuneaton) each said he would be glad to give a similar amount, and the latter suggested that an effective start might be made then and there in forming a nucleus.

Mr. R. S. RAMSDEN (Leamington) suggested that Mr. Wilson should be added to the Committee for dealing with this particular matter; and this was agreed to. Mr. Ramsden thought the subject should be dealt with at once; it would be inadvisable to delay the scheme until next March.

The PRESIDENT: I think the best plan would be for the Committee to draw up a scheme; and then this might be submitted at an extraordinary meeting called for the purpose.

The resolution was carried; and the President, in reply to a question, said an excellent lead had been given by promises of financial help, and he hoped members would take the hint and send along contributions to the Secretary.

The reading and discussion on Mr. Caton's paper on the "Gas Regulation Act" were then taken.

A paper on the "Effect of Chlorides in the Distillation of Coal" is to be read by Mr. A. E. Findley next Friday before the Liverpool Section of the Society of Chemical Industry.

The annual general meeting of the Midland Section of the Coke-Oven Managers' Association will take place in the Grand Hotel, Sheffield, next Saturday. Mr. J. A. Davy will deliver his Inaugural Address.

THE GAS REGULATION ACT, 1920.

Observations upon an Application for an Order under Section 1 of the Act and General Procedure Thereafter.

By W. E. CATON.

The Gas Regulation Act, 1920—an Act to amend the law with respect to the supply of gas—received the Royal Assent exactly six years after one of the most memorable dates in the history of the world—viz., Aug. 4, 1914. The gas industry during these six years suffered more, and was treated worse, than any other industry in the kingdom, in spite of the patriotic and generous service rendered by the industry in the supply of war munitions. Speaking of the work of our industry during the late war, the late Lord Moulton, Director-General of Explosives Supply, stated:

> "Without the direct aid of the gas industry, and, further than that, the assistance of and the knowledge which has been acquired by those who have devoted their lives to it, it would have been perfectly impossible for this country to have waged the campaigns of the last three years, or even for any but a trifling time to have resisted the overwhelming flood of enemies that was poured upon it. When I was first asked to take charge of the manufacture and provision of explosives, it took me but a few days to realize my absolute dependence upon your industry."

The Temporary Increase of Charges Act, 1918—a very niggardly Act—only prevented things from being actually worse than they otherwise would have been by allowing gas undertakings to pay three-quarters of their standard, maximum, or pre-war dividends, whichever was the smaller. This, in several instances, gave shareholders less than 50 p.ct. of their pre-war dividends, which was again reduced by the high rate of income-tax. This is now past history, and our thoughts must be concentrated on the present and future of the industry under the new conditions.

The Gas Regulation Act provides for changing the method of charging for gas from volume of an indefinite heating value in many instances to definite potential heat units supplied; each gas undertaking to declare the calorific value of the gas intended to be supplied. Power is given to the Board of Trade to sweep away provisions requiring gas undertakings to supply gas of any particular illuminating or calorific value, and to modify the provisions affecting the payment of dividends by adding to the standard or maximum price such figure as can be directly attributed to extra cost incurred of production and supply of gas due to the general advance in materials and labour occasioned by the war. It also provides uniformity of testing conditions for the country; and, by way of a Special Order under section 10 of the Act, provides means for statutory gas undertakings obtaining at much less cost supplementary powers which previously could only be obtained by a Special Act of Parliament or a Provisional Order. Any undertaking may apply for an Order under section 1 of the Act; and if an undertaking fails to apply for an Order before August, 1922, the Board of Trade may make an order applying the new method of charging to that undertaking.

For the benefit of those who have not yet sent in their application, I can assure them that an application for an Order is not such a formidable task as appears on first looking at the schedule required to be filled in by the Board of Trade. Some undertakings do not keep their accounts or present their balance-sheets in such a form as would enable them to dissect each item of charge specified on the schedule. From my experience, however, the Board of Trade will accept these lumped together as shown on the balance-sheet. Any income-tax on profits, however, charged in revenue account should be deleted, and a note made on balance-sheets sent with the application of the amount included in each year under this heading.

The most difficult part of the whole schedule to deal with, however, is the completion of Columns T., U., V., and X. It may be assumed the Board of Trade will allow an amount under repairs of works and mains for deferred renewals occasioned by war conditions. The cost of such renewals should be carefully estimated, and the amount arrived at divided by five; or, in other words, allow for this expenditure to be spread over a period of five years. In estimating the increased cost of manufacture and distribution, due to war conditions, the Board of Trade appear to assume in most, if not in all, cases that the pre-war standard of quality was 500 B.Th.U. per cubic foot, or 5 therms per 1000 c.ft. Though on the schedule the Board of Trade ask for returns for 1912, 1913, and 1914, and an average of these three, it would appear they usually take the year 1914 as the basis year. If you assume that line 37 shows the cost of gas in 1914 as 25d. per 1000 c.ft. (the cost per therm would be 5d.) and that the estimated cost per 1000 c.ft. to-day of 450 B.Th.U. gas is 54d., or 12d. per therm, it is evident the increased cost of manufacture is 7d. per therm. Now assume that your pre-war standard or maximum price was 3s. 9d. per 1000 c.ft., which is equivalent to 9d. per therm; your new standard or maximum price will be 16d. per therm. If, under your present Act, you are entitled to charge 6d. per 1000 c.ft. extra for gas supplied outside a given radius, this sum, divided by five, or 1⅕d., will be the extra amount you will hereafter be allowed to charge per therm for gas supplied in this area.

The application has to be accompanied by:

(*a*) The schedule referred to above (in triplicate) together with a copy of the published accounts of the undertakers for the

specified periods and a statement of the price or prices charged for gas during each of these periods.

(*b*) A list of the enactments and other provisions now in force requiring the undertakers to supply gas of a particular illuminating or calorific value.

(*c*) A list of the statutory and other provisions now in force affecting the charges to be made by the undertakers, including, of course, any Order under the Temporary Increase of Charges Act, 1918.

In addition, a cheque according to the size of the undertaking has to accompany the application—namely:

Undertakers supplying during the last complete year ended Dec. 31:	
Up to 100,000,000 c.ft. of gas	£10
100,000,000 c.ft. and less than 500,000,000 c.ft.	20
500,000,000 c.ft. and over	30

Pamphlet No. 1826, "Statutory Rules and Orders made by the Board of Trade," gives all particulars required of the method of procedure in applying for an Order, together with instructions as to advertising and notifying the various local authorities of the intention to apply. Before an Order is made by the Board, an interview with the applicants at the offices of the Board of Trade is granted. This gives the applicants a chance of substantiating their figures if necessary.

After obtaining an Order, the question uppermost in one's mind is, What quality of gas shall I declare to supply? When considering this question, it must be remembered that more than 5 p.ct. lower quality than is declared carries with it on summary conviction a forfeiture of a sum not exceeding £5 for every complete 1 p.ct. by which the calorific value is deficient in excess of the 5 p.ct. margin, except if it can be shown that the deficiency was due to circumstances beyond their control. Again, if in any quarter the average calorific value of the gas as ascertained by the gas examiners is less than the declared calorific value, a sum which the Chief Gas Examiner shall determine shall be applied in the case of a local authority to a reduction in the price of gas and in any other case be deducted from the amount applicable to payment of dividends. Further, the question of maintaining a minimum pressure of 2 in. in any main or service pipe of 2 in. diameter and upwards is one which I am afraid will, in many instances, be a very difficult matter without increasing the size of mains or increasing the initial pressure at the works or the laying of high-pressure feeder mains.

At the moment, to my mind, it is an impossible task to fix upon a definite calorific value and feel any considerable degree of confidence that it will endure as the correct thing economically. With coke slumping in price, if one has a water-gas plant it would undoubtedly be most economical to work it to its utmost, and, if necessary, supply a lower grade gas. But it must be remembered that under the Act the gas undertakers are responsible for altering, adjusting, or replacing, if needs be, burners in consumers' appliances each time an alteration is made in the declared calorific value. Then, again, when the return for residuals approaches the cost of coal, then the cheapest gas to supply is that carrying the maximum number of heat units that can be efficiently utilized by the consumer. My advice, therefore, to those in doubt is to carry on and declare (say) 10 B.Th.U. per cubic foot lower than you are now supplying, unless, of course, new plant has been installed to enable you to make gas of a different quality.

Rules and regulations are also issued for obtaining an Order under section 10 of the Act. By this section an undertaking can obtain, by much shorter and less expensive means, practically anything it could get previously by Special Act of Parliament.

The Act, I consider, on the whole, quite good when it is remembered that it was more or less the result of a compromise in order to obtain financial relief, as it provides for the restoring of the stability of the industry, and will allow of development in the manufacture of gas which, without it, would have been impossible. The consumer is protected by the testing arrangements provided for in the Act for the whole country.

The Gas Referees, under the Act, have drawn up a "Memorandum" for the information of local authorities and Quarter Sessions for the appointment of a competent and impartial person to act as gas examiner. For the present, this gas examiner will be required to visit the testing-place at intervals of time, which need not be strictly equal; and the minimum number of visits will probably be for gas undertakings supplying:

More than 1000 million cubic feet per year	One each day.
Less than 1000 million and more than 250 millions a year	One each week.
Less than 250 millions and more than 100 millions a year	One each fortnight
Less than 100 millions and more than 50 millions a year	One each month.
Less than 50 millions a year	One each quarter.

A gas examiner may be appointed to act on behalf of any number of local authorities.

There are certain undertakings who would prefer to continue to charge as at present, provided they obtained financial relief, but an application for an Order under section 1 of the Act for financial relief carries with it the assumption that the applicant is prepared to adopt the heat-unit basis of charging. To sell heat units, to my mind, is something more definite than the present 1000 c.ft. of very varying qualities of gas; and it facilitates accurate comparisons between the results obtained at different works, as previously a sale of 12,000 c.ft. per ton at one works might be no better, from a heat-unit point of view, than 10,000 c.ft. at another.

There is no doubt that consumers will be some time before they thoroughly understand the new method of charging; but I think they will eventually look upon it with less doubt than at the present time, because they will be buying a definite number of heat units of a definite quality. If undertakings, when they commence selling by heat units, will lay themselves out to assist the consumers in understanding the change, it will materially shorten the time of confusion.

It was in 1909 that, by agreement with the London County Council, provision was made in the Gas Light and Coke Company's Act of that year for a standard of calorific value. The sale of gas in value of British thermal units in reality commenced from this date, although the charge was continued at the rate of so much per 1000 c.ft. The sale of gas by therms is the outcome of the experience gained by this innovation; and the reason for it is not far to seek when it is remembered that practically every operation for which gas is used to-day depends not upon its illuminating power, but upon the heat units it contains.

You will remember that the question of limitation of inerts and carbon monoxide present in the gas was referred to Special Committees to report upon, with a result that in each case the Committee have recommended that no limitation is necessary. This is the only conclusion at which they could arrive. Gas being sold by the number of heat units it contains would not attract such attention to dilute with valueless inerts in the same way as if sold by volume of an unknown British thermal unit content. As regards carbon monoxide, the recommendations of the Committee are good, and time alone will tell if a limit should be placed upon it. Personally, I think it will not be found necessary.

There can be no doubt an extended field of research into improved methods of manufacture is, therefore, thrown open to us. Although the carbonization of coal in gas-works for the production of heat units distributable to the community is an efficient process, there is ample scope for improvement. From the point of view of those responsible for satisfying the consumer and persuading him to maintain and increase his consumption of gas, the advantages of the Act more than outweigh the disadvantages. When comparing the relative advantages of gas and electricity, a fair average, after making allowances for varying efficiencies of conversion from potential heat to actual light, heat, and power, is: For lighting, 5 units of electricity being equivalent to one therm of gas; for power, 10 units; and for cooking and heating, 20 units.

From the point of view of accountancy, for the ordinary consumers a number of gas undertakings do not use meter cards. For those who do not, and do not propose to do so, it will be necessary for them to state on their accounts the declared calorific value of the gas, as the following sample illustrates:

Old Method.

	£ s. d.
70·7 meter index at beginning of quarter.	
80·7 " " end "	
10,000 c.ft. consumed at 5s.	2 10 0

New Method.

Declared calorific 500 B.Th.U. per c.ft., or 200 c.ft. = one therm.	
70·7 meter index at beginning of quarter.	
80·7 " " end "	
10,000 c.ft. consumed equal to 50 therms at 1s. =	2 10 0

Personally, I am in favour of the meter-card system; and this system we have adopted at Oxford.

Meter-cards should not only, as previously, show the reading of the meter and the amount consumed in cubic feet, but also the equivalent in therms. The declared calorific value of the gas should also be shown on the card, with an example of the method of conversion. The inspection books should contain the state of the meter, together with the consumption in cubic feet, and its equivalent in therms. If this method is adopted, the consumers' accounts need only show the therms consumed calculated at the therm price.

From our experience—which is a short one so far, being one quarter only—we have no reason to regret having adopted this system. Being the first quarter, meter cards have had to be delivered and a place near the meter found for them. Our inspectors not being accustomed to the work of conversion and entering index and consumption in cubic feet and therms on cards, the time taken by the same number of men has increased by 20 p.ct. I hope next time, however, this will be reduced to (say) 10 or 15 p.ct. upon the time previously taken. So far as office work in our case is concerned, less writing on the consumers' accounts practically counterbalances the additional work involved on the ledgers, although there is an extra calculation to make. Those undertakings that have old rentals and inspection books to use up can easily carry on by adding a column in each for therms. In order to save time and trouble, therm calculators and comparative therm tables and slide-rule calculators are already on sale, and will be found of great assistance to anyone responsible for providing this information to their staff.

As regards slot consumers, those undertakings that at the time of applying for an Order have an amount stated in their Acts for gas used through a slot meter will have an amount per therm stated in their Order for this purpose. Others will, I presume, adopt a similar charge. In our case, we have set the meters as near as possible at the rate per therm converted into cubic feet,

rather under than over if an exact conversion cannot be made; and the excess in the meter is handed-back to the consumers.

I have endeavoured to give a short review of what led up to the Government's passing the Gas Regulation Act of 1920, the method of procedure in applying for an Order under section 1 of the Act, and my suggestions of what to do after the Order has been obtained, which I trust will be of interest to those undertakings that have yet to make their applications.

DISCUSSION.

The PRESIDENT (Mr. James Paterson) opened the discussion. They appreciated Mr. Caton's paper, he said, for it was interesting and dealt with the subject thoroughly. His observations would be of assistance to those who had not yet made an application for an Order in framing it, as well as the schedule. He noticed with interest that Mr. Caton referred to the allowance for deferred renewals—that was renewals of plant and apparatus deferred owing to war conditions. Most of them were behindhand with such renewals; and he was interested to hear from Mr. Caton that the Board of Trade recognized the desirability of spreading these deferred renewals over a period of five years. In his own application, he spread them over ten years; but he did not know how the Board of Trade had dealt with the matter. He went on to say that it was his firm conviction that calorific value should be maintained as steady as possible. He suggested to any distribution engineers present, as well as to those concerned in manufacture, that it was the steadiness and constancy of supply which had won, and would continue to win, the favour of the consumer. It was probable that the threat of forfeit would keep them well above the penalty-line; but let this not be the only deterrent. He advised them to send out as level a quality as possible—barring accidents, provision for which was made under the Act. The point regarding the pressure in the mains was, of course, a very difficult one. Some of them were well situated as regarded their supply mains in the various districts; but those who were not were obviously going to have difficulty to-day in bringing-up their mains system to a point at which the undertaking could safely guarantee a minimum of 2 in. pressure. It was the heavy cooking consumption on Sunday morning, especially in the summer, which tested their mains capacity more than anything else. He was a little bit doubtful about the practical wisdom of Mr. Caton's suggestion that they should carry on, and declare (say) 10 B.Th.U. lower than they were now supplying—unless, of course, new plant had been installed to enable them to make gas of different quality. It must be remembered that they were sending out therms; and if they were going to send out 10 therms less to-day than the previous day, they had got to make it up in some way. Their multiplier being their therm value—that was the declared value—they had to maintain it, and they were in danger of not sending out so many therms per ton if they lowered the declared value below what they were supplying just before the Order. It did not follow that they were going to sell more therms per ton because they were lowering the calorific value. This was not a plea for a high calorific value or the decrying of a low calorific value. But it was almost impossible to-day for many of them to say what was the calorific value they should distribute to produce the most economical number of therms per ton. It was a question they had to determine for themselves. If they were dealing with straight coal gas, without any water gas, he assured them that it was no benefit to send out a low quality, for the simple reason that a straight coal gas was of a higher quality, than a diluted gas, whether diluted with water gas, producer gas, or anything else.

Mr. J. FERGUSON BELL (Derby) observed that the new Act had been happily described as conferring a fresh charter upon the gas industry; for in future they were to sell their gas according to the definite number of the heat units that it contained, instead of by volume. He had no doubt that when consumers thoroughly understood the Act they would appreciate its benefits. Volume had been to some extent varying; but henceforth gas would be measured by the potential energy it contained. It would be well if consumers of heat energy—whether electricity, oil, or whatever it might be—would apply this test. The Act gave reasonable freedom to all gas undertakings; and this was an important point, because it would enable them to take advantage of the different methods of carbonizing, so as to get the greatest number of therm units to the consumer per ton of coal used. He was not quite in agreement with Mr. Caton as to the standard which they should declare. His idea was to declare as soon as possible the actual value of the gas supplied; and he urged them when they did declare a value to be careful to see that it was a calorific value which met with the approval of the consumers. He might be somewhat old-fashioned, but his idea was that a gas of from 480 to 500 B.Th.U. would meet the actual requirements of consumers; and he believed a gas of this quality would be more profitable to sell than some of the very low quality gases that they heard about. With reference to the declared value, he advocated 500 B.Th.U.; and then if they were going lower (to 450) it ought to be by stages of 10 units, so as to avoid the second decimal point, and for ease of calculation. Regarding the necessity of maintaining 2-inch pressure during hours of maximum consumption, he said it was to be hoped the Board of Trade would permit reasonable elasticity in this matter. In his opinion, it was only right that they should recognize that the Board of Trade were administering the Act in an impartial and fair spirit, and were trying to do justice both to the gas consumer and the gas companies. There was no doubt that, unless the Act had been passed, a number of gas companies would have had to go under.

Mr. GEORGE HELPS (Nuneaton) insisted that gas was bad only when it was improperly applied. They were always considering the quality of the gas that they had in the holder, and not that gas mixed with air that the consumer used. He maintained that it could easily be demonstrated to consumers generally that they could get the same flame temperature with gas of half the quality that was being sent out. They would not believe it, he knew, but he was telling them what was a fact. He did not think that at the moment they could answer the question as to what was the quality which, with existing plant, they could supply at the cheapest rate per therm. Later on, however, it would be possible, and the selling of gas by the therm would teach them the quality that it was desirable to sell. As to the quality of 480 B.Th.U. and so on, he was quite content to leave it to the future, with the strongest possible opinion that all these qualities would be divided by two.

Mr F. SHEWRING (Stratford-on-Avon) said he was of opinion that in future it would be necessary to consider seriously the specific gravity of the gas distributed.

Mr. C. M. D. BELTON (Shrewsbury), referring to Mr. Caton's advice that they should declare 10 B.Th.U.'s lower than they were now supplying, contended that it would mean considerable financial loss. It would be all right as a limit of safety to work to, but they ought, in his opinion, to aim at something better.

Mr. C. H. WEBB (Stourbridge) observed that they could not vary their proportions of coal gas and carburetted water gas unless they had a respectable surplus of plant.

Mr. F. C. BRIGGS (Dudley) told the meeting that with blue gas he got a very objectionable deposit upon the bells of his station governors, and had been unable to get rid of it.

Mr. P. N. LANGFORD (Coventry) thought that the point as to the calorific value to be declared was a matter which each undertaking had to work-out for itself. The engineer knew the requirements of his locality, and how to deal with the question of residuals, coal, coke, and so forth. In Coventry, he proposed to go for 470 B.Th.U., which he found was the most satisfactory quality. He regretted that he could not help Mr. Briggs in his dilemma. He had used quite a lot of blue gas without experiencing the trouble named.

Mr. BRIGGS added that in his case the two gases were purified separately, and were mixed in the district gasholder.

Mr. W. S. MORLAND (Gloucester) said he had mixed a great deal of blue water gas with his coal gas; but unlike Mr. Briggs they purified their gas with the coal gas, and they had not experienced any difficulty. He had not yet determined what calorific value to declare, as the point had not arisen; but he agreed that each undertaking had to consider its own position. One question involved was the sale of coke. If they were going to distribute a very high quality gas they would have to make more coal gas, and consequently would produce more coke than they had a sale for in the district. It would therefore pay them to sell gas of a lower calorific value in order to regulate the supply of coke for the district.

Mr. CATON, in reply to the discussion, said his suggestion that they should declare 10 B.Th.U. lower than they were now supplying had been criticized; but he pointed out that it did not mean that he recommended they should always continue to supply 10 units higher than they declared. He asked gentlemen who raised the point whether in the old days when they had a 14-candle standard they always worked to it. He believed they would find that the majority worked nearer to 15 than 14 candles.

After a few complimentary remarks by Alderman H. J. Southall, of Leominster, and Mr. Aston, of Cheltenham,

Mr. W. M. MASON (of the British Commercial Gas Association) reminded members that the Gas Regulation Act was the result of the splendid work of the National Gas Council. He also called attention to the helpful work done by district meetings, at which the sales side of the gas business was emphasized. He urged that if a meeting could be arranged in the Midlands for next year, it should have their hearty support.

Mr. HELPS dissented from Mr. Mason's claim that the National Gas Council were responsible for the new Act. He had given no grounds or authority for the statement, and he (the speaker) did not think that history would attribute this piece of work to the Council.

Mr. BELL insisted that if it had not been for the services of Mr. Milne Watson, to whom they owed a deep debt of gratitude, the Act would not have been on the Statute-Book to-day.

Mr. LANGFORD, referring to Mr. Mason's remarks, suggested that a District Conference be held at Coventry. He fully realized the value of the work the British Commercial Gas Association had done.

The PRESIDENT hoped Mr. Langford would be able to secure the approval of his Committee for a District Conference of the B.C.G.A. to be held next year at Coventry.

The meeting cordially endorsed the suggestion in favour of the meeting at Coventry.

Oriental Gas Company, Ltd.—At the meeting next Wednesday (Nov. 30), the Directors of the Company will submit the accounts for the twelve months ended June 30, and will report that the revenue account presents a satisfactory result. The gas rental continues to show annually progressive increase, amounting for that period to £2968 in excess of the figures for the preceding year. The significance of this fact will be better appreciated when it is remembered that the Company's business was seriously dislocated by the general strike in Calcutta in October, 1920. The amount yielded by the sale of residual products is higher than that of the corresponding return for the year 1920 by £10,591, chiefly owing to the large demand for coke. During the financial year the exchange value of the rupee has ruled above the par value of 1s. 4d., and has produced a profit of £4336. In result, the balance of revenue account carried to the credit of profit and loss is £31,334. During the year the Directors have been able to make fairly good progress with those projected operations on the Company's works which were being held up by the war and its paralyzing consequences. Chief among these operations are the new retort-house and the new gasholder, which, when completed, will enable the Company to meet the ever-growing demands for gas for light, heat, and power. The Directors with great regret announce the death of their esteemed colleague, Mr. A. T. Eastman, who had been a member of the Board for 24 years. His matured experience and his general business qualifications were highly valued; and the Directors feel that they and the Company have sustained a great loss. In conformity with the provisions of the Company's Articles of Association, they have appointed Mr. B. M. Gill, one of the Auditors, to the seat at the Board thus rendered vacant, and have appointed Mr. F. J. Bradfield to the vacated auditorship. The Directors recommend the payment of a dividend at the rate of 4½ p.ct. (less income-tax), making, with the interim dividend of 3½ p.ct. (less tax), a total dividend of 8 p.ct. (less tax) for the year.

ILLUMINATING ENGINEERING DEVELOPMENTS.

There is a burst of activity in the scientific lighting world; and so responsible gas officials will be keeping a keen eye on what is doing, and what achievements are effected in the way of new developments. Of course, the Illuminating Engineering Society is neutral in respect of illuminants. It prides itself upon that; and its mission is the appreciation of scientific treatment to any lighting agent, in the interests of all concerned—suppliers as well as users. The members of the Society held their first meeting after the vacation on Tuesday of last week, and a very interesting couple of hours were spent. The time was mostly occupied in inspecting exhibits, and hearing explanations.

Progress During the Vacation.

Prior to the exhibits claiming attention, the Hon. Secretary (Mr. Leon Gaster) made a statement as to the happenings during the vacation. He first referred to the arrangement by which Presidents of Kindred Societies become members of the Council during their tenure of office. He mentioned the various societies, which include the Institution of Gas Engineers and the Society of British Gas Industries. We are not industrially interested in kinema studio lighting or motor head lights, however much we may be so personally. But he proceeded to refer to the second interim report of the Home Office Departmental Committee on lighting in factories and workshops, upon which we have already commented largely in favour, while opposed to the recommendation in regard to the suppression of glare, applied without discrimination to all forms of lighting. We understand from Mr. Gaster's statement that the recommendations of the report will form a useful subject for discussion before the Society, with a view to a full elucidation of the various points raised. He also glanced at the work that has been done by the Illuminating Engineering Societies abroad; and one interesting point is that recent researches in the United States appear to establish the direct relation between lighting and efficiency of work. Actual records of time consumed in various industrial operations, by the original and improved illumination, are presented in an article by W. Harrison, O. F. Haas, and F. E. Dopke. A general increase in production of 12·2 p.ct., with an increased expenditure on lighting equivalent to only 2½ p.ct. of the wages bill, is recorded. He also mentioned that a gratifying illustration of the restoration of co-operation on the part of experts in different countries was afforded by the first technical session of the International Illumination Commission, which took place in Paris last July. A resolution was passed endorsing the adoption of the international candle—the unit already in use in this country, France, and the United States; and a tentative series of definitions of the chief photometric quantities has also been framed. This was the first occasion on which a series of technical papers has been submitted to the International Illumination Commission; practical questions arising in connection with industrial lighting, photometric problems, &c. As a result of these discussions, international technical committees are being formed. This step will doubtless be useful in paving the way for international agreement on many outstanding questions, notably the problem of devising ultimately international codes relating to the lighting of factories and schools, &c. In concluding his observations, he said the subject of illumination having now been internationally adopted, it was hoped that in the new period of peace we might see illuminating engineering taking its proper position in the affairs of everyday life.

Electric Lamp Progress.

Then we settled-down to a consideration of the progress report of the Electric Lighting Committee; but it was regretted to learn privately that the Gas Lighting Committee were not presenting a report on this occasion. From the former, however, members heard that electric lamps are coming into more general use. The lamp manufacturers are actively engaged on research work, in order to place in the hands of consumers high efficiency lamps in view of the high cost of current. Regarding gas-filled lamps, it was reported that further improvements in manufacture have taken place which will allow them to be used of lower candle power on the higher voltages. This being so, it was anticipated that such lamps will be applied more and more to domestic purposes. This naturally raises in one's mind the point that the higher efficiency will reduce the revenue derived from domestic lighting service by the supply undertakings. A further point was that the fittings manufacturers have been working in collaboration with the lamp manufacturers, so as to provide fittings suitable for the new lamps—partly with the view of obviating glare.

Reflectors and Distribution.

Following this, there was an exhibition of new forms of reflectors, which have been particularly designed for the purpose of getting a more extensive distribution of light from gas-filled lamps, seeing that the light given by these lamps is, without such auxiliary aid, very concentrated in character. This is a problem that has been engaging much attention; and it is claimed for the new reflectors that they are a practical means for securing a larger distribution of light at the useful angles. The reflectors have been especially designed for industrial lighting; but at the same time a great deal of attention is being devoted to street-lamps. A point which is not always appreciated is that, according to the candle power of lamps, there should be a difference in the diameters of the reflectors. For example, for a 100-watt gas-filled lamp, it is desirable that the reflector should be 14 in. diameter; for a 200-watt lamp, 16 in.

The Benjamin Lightmeter.

Mr. Haydn T. Harrison next interested the members with a description of the "Benjamin" Lightmeter, which is a simple portable apparatus to measure illumination, and enable one to give intelligent and expert advice on factory lighting. Of course, people are now beginning to think of, and to deal more with, useful illumination as apart from the actual light given by a lamp source; and so those who have the arrangements of lighting installations in their hands require a simple instrument for testing and maintaining the illumination, that is required for any given purpose. Mr. Harrison claims that the simple instrument he described will effect all the needs in this regard. The lightmeter is quite a compact instrument—measuring only 9½ in. long by about 3 in. square; and it can be slipped easily into the pocket, and so is always at hand for service.

The main features of the instrument are that it embodies an albedo surface, easily cleaned, which is illuminated to various degrees (the value of which is indicated on a scale) by a small incandescent electric lamp fixed in the case. Above this surface is an opaque sliding cover, having two small openings, through one of which the scale reading can be noted. The larger opening contains a Bunsen disc having a translucent centre. Thus, when the light to be measured falls on this disc, the outer portion is illuminated by it, the centre portion being illuminated from the albedo surface below. By moving the sliding cover and screen, a balance can be obtained which indicates on the scale the degree of illumination obtained. The advantages of the instrument, Mr. Harrison said, are: Simplicity, ease, and accuracy of operation. Both eyes being used, there is no fatigue. The instrument has small weight, and the cost is low.

The instrument is intended to be used where it is desired to make rapid measurements of illumination or candle power, within the degree of accuracy necessary for practical purposes. It is used in conjunction with a two-cell (4-volt) accumulator, which, provided that the battery is in good condition (or has not been lately charged), will give the voltage mentioned in a certificate. Accumulators, or dry cells with suitable rheostat, contained in a wooden case can be obtained. When specified these are fitted with an ammeter, which will indicate the current taken; thus allowing for a correction should the current not be in accordance with the certificate. To use the instrument, the leads supplied should be connected to the battery, and the working screen uncovered by opening the hinged end. To obtain a photometric balance, the screen is moved backwards and forwards until the grease spot in the centre attains the same degree of luminosity as the comparison screen surrounding it. The illumination in foot-candles is then indicated in the opening immediately above. The range of the instrument is from 0·5 to 20 foot-candles; but, if desired, this can be varied for special purposes. To measure illumination from any particular light source, the instrument is held in a convenient position, with the screen facing the light source and operated as already described. To measure illumination on any particular plane—such as horizontal illumination in the street, or on a table, or an inclined plane such as a desk, or vertical illumination such as a picture—the instrument is held against the surface so that its comparison screen is parallel with it, or in the street can be held horizontal at the desired height, and used as previously stated. In measuring for candle power, the instrument is held at a definite distance in feet from the light source to be measured with the screen directly facing. The reading in foot-candles when multiplied by the distance squared will give the candle power of the source. Care should be taken to move the slide to the closed position and cover the screen with the hinged cover when the instrument is not in use, as the accuracy is materially effected if the working screen or lower surface becomes dirty.

Miscellaneous.

Among subsequent exhibits, the latest developments in the Sheringham daylight system were shown, and subsequently the use of Neon lamps for illuminating signs. The whole evening was filled with interest, and exhibitors were thanked for their contributions to the proceedings.

YORKSHIRE JUNIOR GAS ASSOCIATION.

A Meeting of the Association was held last Saturday afternoon, in the Bradford Corporation Gas Department Showrooms, Darley Street. The President (Mr. Peter M'Nab, of the Low Moor Gas-Works) occupied the chair.

Mr. E. Gillett, Superintendent of the Thornton Road Gas-Works of the Bradford Corporation, read the following paper:

THE WORKING OF CONTINUOUS VERTICAL RETORTS.

Heating.

The heating of vertical retorts should be as regular as possible. Temperatures from 1150° to 1250° C. in the flues are good and safe regular working temperatures. Dampers need attention and cleaning at least once a month. Each main damper should be

taken-out, cleaned, and reset carefully; all heating zones being examined after replacement to see that the gases are being distributed evenly.

Coal.

Coal is bought as screened, unscreened, nuts, nut slack, and slack. Yorkshire nut slack and slack work very well, giving an even quality gas and a very good coke. Rough coals do not work so well as nut slacks. With rough coal a very loose and open charge is obtained, and where steam is in use in any quantity, the steam gets away before it has become fully decomposed. The pasty layer is not so firm when using rough coal as with small coal; the pieces being extended, the layer is not so thick and even; the smaller pieces melting and sticking together more easily. Stopped pipes are also more frequent with rough coal; the heat from the retort being carried off more freely, and thus drying-out the pipes and causing pasty depositions at the first bends. The ammonia liquor is also affected greatly; the strength is lower, owing to the uncracked steam diluting it. The tar also forms an emulsion with the coal dust and water, and there is great difficulty in bringing about separation of tar and liquor. With nut slacks and slacks the charge is more compact, and the pasty layer formed is much firmer, and, in conjunction with the action of the coke-extractor, gives the necessary time-contact between the steam, coke, and carbon to bring about the production of a good water gas.

When coal is tipped into large coal-bunkers, separation of large and small coal takes place—slacks and nuts in the centre, and the large rough coal rolling to the outsides. The retorts fed from the centre of the hopper will receive small coal and the outer retorts the rough coal. This working side by side is very interesting to follow. The small-coal retorts are better working retorts than the outer ones, which get the rougher coal. The gas given off is of a better and more even quality; the colour of the foul gas being a good yellow, while the outer retort gas is more grey in colour, and contains more uncracked steam. The pricking-down of the retorts is more efficiently and evenly done with the retorts fed with small coal. With rough coal, the lumps lie in the way of the pricker and prevent penetration of the charge. The lumps take quite a lot of breaking through, and thus pricking-down does not always get done correctly.

Draw or Pull on the Retorts.

The pull on the retorts should be as little as possible, but sufficient to give comfortable working for the stokers. A good, compact charge in a vertical retort can be worked comfortably with one-half to one-tenth of pull on the top of the retort.

Coke-Extractors.

The extractor engines should be set to run at the most economical rate or speed, and should be frequently timed to check their speed. Erratic running will upset the working of the retorts just as much as inattention at the top will do. With too quick running the coal will pass through the retorts too quickly, and the core of the charge will remain uncarbonized, causing waste. Should there be any sticking-up of the charge at the top, the nearly carbonized mass will quickly leave the uncarbonized portion, causing a free space to be formed in which things are happening, varying according to the condition of the retort, the pull thereon, and the draught in the flue. It may mean the formation of a small combustion chamber in the free space just mentioned and the possible burning-out of the retort side. It is better to work with a slightly bigger pull in the flue around the retort than in the retort, and thus prevent serious happenings from faults in the retorts, such as cracks, open joints, &c. A greater pull in the retort would draw in oxygen; and this, burning with the gases inside the retort, causes the temperature to rise high enough and sufficient to cause serious damage to the retort itself. A bigger pull in the flue then means coal gas in the flue to excess and a fall in temperature, not a rise. The discharges from the retorts should be watched, and all smoky discharges reported to the foreman at once, and also small discharges. Pawl jaws slipping, safety devices breaking, acceleration or stopping of engines, or obstruction around extractors, should be attended to at once.

Steaming Retorts.

Steam can be supplied up to (say) 40 lbs. pressure through a reducing valve. The determining pressure used is dependant upon the quality of the gas required. If 500 B.Th.U. gas is wanted, steam at about 12 lbs. pressure through a $\frac{5}{16}$ in. nozzle will get it with Yorkshire nuts and slack. Excess of steam means high CO_2 content; and the amount of water vapour to be condensed out of the gas will cause the condensers suddenly to become too small and overtaxed. My idea about this is that the resistance of the pasty layer is broken down, and the time contact between the steam and the coke is shortened. This points to the fact that the gas mostly travels around the charge in the retort, and does not pass through the coal mass, excepting the portion above the pasty layer.

Exhausters.

Exhausters should be run so as to cause as little oscillation as possible. Oscillation will lower the quality of the gas, and should be avoided. It also assists in blocking-up the ascension pipes. Retort-house governors might overcome this slightly; but they require quite a lot of attention in cleaning to free them from ammonia, carbon, and pitchy products.

Carbon.

Without steam, carbon forms fairly rapidly in vertical retorts; and this requires removing about every five weeks. With steaming, this period is considerably extended; cleaning only being necessary three or four times a year. This fact proves that the higher hydrocarbons are protected by the non-destructible gases formed by steam and carbon.

Standing-off Retorts and Restarting for Week-Ends and Holidays.

Where storage room for gas is limited, it is often necessary to stand-off some of the gas-making plant for week-ends and holidays. There is no difficulty in standing-off and restarting continuous vertical retorts. Our method is as follows: Work down the coal to about a foot below the gas off-take, and then put the coke-extractor out of action. Empty the coke-box and lute-up the lid. After about an hour from stopping the extractor, close the gas off-take valve so that there is a slight pressure on the retort. Go over all coal-boxes and see that they are empty. Gradually close the gas-valves as the gas make falls off. At about three hours' end the steam may be shut-off and the gas-valves again adjusted. As gas making ceases, the gas quality falls off, and the gas-valve may be shut-off, and balls turned up when the quality becomes too low. The retort-house governors and the exhausters must be reset to reduce the make. The primary slides may be reduced to half, and the main dampers closed, or, if a good fit, just eased-off—say, $\frac{1}{2}$ in.

Restarting.

Reset the slides and dampers. With the pricking-down rod, go over each retort and break-open the top of the charge from the centre, so as to cover the top of the retort. Charge with coal and restart the extractors. As gas is given off at once, the gas-valves may be eased a little. Follow with the pricking-rod each half hour for two hours, so as to find out any faulty starts. Faulty starts should be stopped at once, to avoid leaving a big free space in the retort. A long rod, inserted either from the top or the bottom, will usually move it. Stoppages are generally caused by a broken coke column or a piece of coke dropping off the side of the coke column and wedging the charge against the side of the retort. Or they may be caused by coal getting down the sides of the coke charge and, becoming pasty, hold the whole lot up. Then it is a case of waiting until this becomes carbonized before any move can be made.

The gas-valves may be opened-up as gas make increases, and at about two hours' end the steam may be put on to the retorts taking coal regularly. The retort-house governors and the exhausters can be reset to old conditions.

Maintenance.

Wear and tear on vertical retorts is less than on horizontals, and maintenance costs are not excessive. Some time ago I read a paper on repairs of vertical retorts, showing that the costs on practically new settings were low. Speaking now, after nine years' working with verticals, I have found that our latest repairs show only a small increase in cost—making due allowance for the extra cost of materials, wages, &c. Steaming has affected the retorts very little, and the bottom regenerator sections, which are now built of hard burned fire-brick, have withstood the wear and tear better than iron. Brick-to-brick joints are sounder than iron to brick; and there is less short-circuiting from the retort to the flues. The greatest repairs are around the heavy carbonizing part of the retorts—that is the top 14 ft. of the retort. Our retort repairs have all been done with silica bricks; and they have stood very well. After three years' continuous working, the faces are certainly rough but workable; and the loss in thickness does not exceed $\frac{3}{8}$ in. If there is any bad effect on the retorts with the use of steam, it is very well-balanced by the saving in scurfing. Scurfing once does more damage to the retorts than twelve months' steaming.

The producers also wear very well; quite a number doing 1300 days without repair. The biggest repair costs are with the coke bunkers and conveyors. The wear and tear on this plant is very heavy. Coke extractors stand very well, running 1300 days without renewal.

I have written these notes with a view to arousing a good discussion. These are from my own experience; and I hope other members interested in verticals will come forward and tell us how they have fared.

DISCUSSION.

Mr. Gillett exhibited a couple of large blue-prints of continuous vertical retort plant to illustrate the points in his paper; and with the aid of these, he answered a number of questions on matters of detail which were put by various members.

Mr. H. L. Bateman (Wakefield) remarked upon the apparent preference by Mr. Gillett for slack coal as against the rough coals. His own experience had been that the greater the percentage of slack, the greater the percentage of inferior material in the coal. He would like to know the effect on the working results with the rough coal as against the slack.

Mr. Gillett replied that if they worked slack which had a big percentage of ash, the gas results were certainly lower. A large percentage of ash in any coal had this effect.

Mr. W. Heathcote (Halifax) asked whether Mr. Gillett favoured coal from any particular coalfield for use with vertical retorts.

Mr. Gillett said at his plant they had used West Yorkshire, South Yorkshire, and Durham coals. He did not know whether they had had Midland coal; but it was possible. Certainly, they had had coal from many sources, including local stuff, and some coal, during the miners' dispute, which had been at the bottom of the Corporation sewage beds for many years; and they had got through all right with

it. There was no doubt that a good Yorkshire wet slack was as fine as anything; but Durham coal had given good working also.

Mr. C. R. INGHAM (Brighouse) said, with regard to the use of slack, it might be interesting to know the effects in working with intermittent retorts. At a plant of which he had had experience, they had tried slack of various sorts; and it went quite well, except that when they came to open the bottom door the coke fell out in a big solid lump, and the stokers got spattered with steam, hot water, &c. With larger material of good class, they did not have this trouble. Of course, with the intermittents they had no pasty layer at the top; it was all burned off.

Mr. GILLETT said it was quite true that, with the continuous plant, they had something of this trouble with the small coal. Large coal went through without any trouble.

Mr. H. BOYES (Harrogate) asked how many tons per day Mr. Gillett calculated per retort. With the plant he (Mr. Boyes) had in mind, the makers guaranteed about 5 tons; but it was found they could get only about 3½ tons.

Mr. GILLETT: That is so. You will not get much more than that for a 5 ft. retort. We find it just about in the same proportion with other-sized retorts.

Mr. INGHAM said, with reference to the formation of an emulsion in the coal dust and the tar and liquor, he should have thought there was not so much likelihood of getting a lot of coal dust into the hydraulic main as there would be with intermittent retorts, because the coal was going down very slowly, and there was not so much dust.

Mr. GILLETT said in the cases he had dealt with, the gas up-take pipe was adjacent to the inlet of the coal. He agreed that the emulsion would be due to the lower specific gravity of the tar, and also to the heat.

Mr. INGHAM asked whether Mr. Gillett found, when steaming, that the amount of fuel required to heat the setting was reduced at all.

Mr. GILLETT replied that he had not found any such reduction; it would be slightly greater rather than otherwise.

Mr. HEATHCOTE supposed Mr. Gillett was aiming at a 500 B.Th.U. value. Could he tell them the gas made per ton?

Mr. GILLETT: Between 15,000 and 16,000 c.ft.

Mr. BOYES asked what was the life of a continuous vertical retort under ordinary working conditions. How long would they last with steaming?

Mr. GILLETT said the retorts of which he spoke had been installed since 1912. Half were the old moulded retorts and the remainder the newer type, where the main wearing was on the top 14 ft.

Mr. F. A. C. PYKETT (Halifax) asked how many times since 1912 the retorts had been let down.

Mr. GILLETT replied that one set had been let down three times, and the other twice, and was ready for letting down next spring. On that occasion members of the Association would be very welcome to go to Thornton Road and have a look at the set. They could go up a retort in a chair, and see what had happened inside.

Mr. DOUGILL said one of the points in the paper appealing particularly to him was the enormous results Mr. Gillett had obtained with comparatively low temperatures. They were undoubtedly marvellous results; and yet the temperatures were only quite moderate. The temperature, of course, was one of the greatest factors in the life of a retort. Fifty degrees would make all the difference between long life and poor life. Would Mr. Gillett give them any idea as to how he got these results with his very modest temperatures?

Mr. GILLETT said a good deal of it, no doubt, was due to the fact that he himself went seven days per week to look after the plant. It was largely a matter of attention, and seeing that things were kept right.

Mr. BATEMAN asked if Mr. Gillett introduced a percentage of air to the steam.

Mr. GILLETT replied that they had no air, except that getting in through the wear and tear around the door at the bottom. They could work with from 12 to 15 p.ct. total inerts all the year round. The carbon dioxide content at the top of the retort was 4 to 5 p.ct. He had no idea of the cost of producing the steam. The figures of carbon monoxide content were 9 to 10 p.ct. without steam, and 11 to 11·5 p.ct. with steam; nitrogen, 6 to 9 p.ct.; and hydrocarbons, 1·8 p.ct. at present, though it varied according to the coal.

Mr. THOMAS SETTLE (who was present as a visitor, and was heartily welcomed by the President) said he had not had much time to study the paper before the meeting; but they all knew that Mr. Gillett was a master-hand at the system over which he had control. On several occasions it had been his (Mr. Settle's) pleasure to visit the Thornton Road works and to see Mr. Gillett's settings, and to notice the uniformity and regularity with which the settings worked one with another. They could hardly go into the question of coal costs and qualities, because coal meant anything nowadays. The ash content had enormously increased since pre-war days; and they all knew the effect of this. Inerts in coal did not make gas, nor did they assist in the producers. Oscillation, the paper stated, should be avoided. This was an important point. It was gratifying to know Mr. Gillett had a good exhauster. Mr. Settle said he had seen some remarkable results of steaming on certain plants. Mr. Gillett seemed to be very fortunate in regulating his steam so nicely. Where was the 40 lbs. pressure? He was very much struck with Mr. Gillett's being able to maintain with great regularity this 500 B.Th.U. gas, with a nitrogen content of only 6 to 9 p.ct. He thought Mr. Gillett could be greatly complimented on the plainness of his paper. Everything in it could be thoroughly understood and easily grasped; and this was one of the most valuable features in giving a paper.

Mr. GILLETT said he was obliged to Mr. Settle for his commendation, which he appreciated. With regard to the steam, the 40 lbs. pressure was on the boiler. The percentage of methane was between 25 and 26; and heavy hydrocarbons, 1·5 to 1·8, varying with the coal.

Mr. F. FRITH (Leeds) asked whether Mr. Gillett was prepared to state any disadvantages of his system.

Mr. GILLETT: If you get the right men, and give proper supervision, there are no disadvantages.

The PRESIDENT said the meeting had heard a very practical paper. The key-word to Mr. Gillett's success with verticals had been "control"—both of the plant and of the human element necessary to work it.

A vote of thanks was accorded Mr. Gillett and Mr. Charles Wood (the Engineer and General Manager of the Bradford Gas Department) for the use of the room that afternoon and for the facilities granted on many occasions to the Association.

SCOTTISH JUNIOR GAS ASSOCIATION.

(WESTERN DISTRICT.)

A Meeting of the Western District of the Scottish Junior Gas Association was held last Saturday week in the Royal Technical College, Glasgow. Mr. JAMES CUBIE, the President, occupied the chair.

MR. M'LUSKY'S PRIZE OFFER.

The PRESIDENT, at the outset, said it was to be regretted that only two members of the District Branch had given intimation of their intention to be competitors for the prize offered by Mr. M'Lusky, the Manager of the Glasgow Corporation Gas Department, for the best paper on "Observations on Visits to Works and Papers Read during the Session." The Council were somewhat disappointed at the response, especially as the prize had been generously offered by Mr. M'Lusky as an incentive and an encouragement to the juniors in the industry.

INCREASED MEMBERSHIP.

Satisfaction was expressed at the announcement that upwards of twenty additional nominations for membership were received. This gave the substantial total of 81 new members for the current session. These figures were eloquent of the progress which was being made by the Association.

EXPERIMENTAL LABORATORY.

Mr. JOHN M'ISAAC (Glasgow) submitted an interesting proposal to the effect that it should be remitted to the Council to consider the expediency and practicability of inaugurating an experimental laboratory or workshop for the use of members. After a full and free interchange of views, the motion was agreed to unanimously.

Mr. PETER SIM (Buckie) then read the following paper:

THE CARBONIZATION OF AMERICAN COAL.

At the time when I was asked by our President to contribute a paper to the "Transactions," I was engaged in work which entailed the daily testing of results obtained in the carbonization of American coal. It occurred to me a summary of these results would be useful, as there may be many in the industry who are not in the position of being able to discover many characteristics of the material they may be working, and to whom the data that I propose to put before you to-day may perhaps prove interesting.

I am no agent or advocate for foreign merchandize if similar goods can be obtained cheaper at home; but, at the time mentioned, we were passing through a period of coal shortage the like of which had never before been experienced, and American coal was hailed as a godsend, especially after our experience of the kind of coal and dross which gas-works were forced to carbonize previous to its advent.

The coal in appearance somewhat belied its true worth—in fact, it was not until a practical test revealed its qualities that its possibilities were fully appreciated. At first glance, the mass of what looked like fine dross and sweepings, with a lump thrown in here and there, awakened foreboding; and it was scarcely credible that results such as were actually obtained could issue from so unpromising a source.

An average sample of the coal was taken and gave the following results:

	As Fired. P.Ct.		Dry. P.Ct.
Fixed carbon	58·89	..	59·81
Volatile matter	30·94	..	31·43
Ash	7·78	..	7·90
Sulphur	0·85	..	0·86
Moisture	1·54	..	*nil.*
	100·00		100·00
Nitrogen	1·52	..	1·54

CALORIFIC VALUE.

As Fired.		Dry.
7768 calories	..	7890 calories.
13,982 B.Th.U.	..	14,982 B.Th.U.

This coal was worked in the Johnstone Gas-Works for nearly two months; and it was found that results could be obtained in gas production and quality of coke in excess of expectations, and better than the figures obtained in any year from Scotch coal. The vertical retorts in use are the "Glasgow" continuous intermittent; and after the difficulties of the first two or three days' changed conditions had been overcome, it was decided to run a week's test, carbonizing in six retorts on twelve-hour charges, in order to save every ounce of coal possible. Except this lengthening of the duration of charge from six to twelve hours, the other conditions were exactly similar to those prevailing with the use of Scotch coal. Steam was admitted at the bottom of the retort through ¼-in. nozzles at a pressure averaging 30 lbs. per square

inch; a very slight pull was maintained upon the retorts; and the hydraulic seal set at ½ in.

The twelve-hour charge was found easiest to work, and freer from "hanging-up" difficulties than eight or ten hours. Our chief trouble, even on the longer charge, was in pokering the coal from the retorts. It was found on swinging open the seal that the coke had gathered in a solid mass, and sometimes fifteen minutes had to be spent in the process before the requisite draw and fall was obtained. Choking of off-take and dip-pipes was not unknown; and on one occasion, while investigating the cause of an excessive pull being required, it was found that the 10-in. foul main, at a point above the setting, was choked to within 2 in. of the top of the bore. Beyond these difficulties, the ordeal was found fairly easy at Johnstone.

The gas obtained upon the twelve-hour charges was of a low-grade quality, which consumers, with a knowledge of the stringency of the times, appreciated in a new manner. Generally, with a readjustment carried out throughout the district in gas-cooker burners, and a reduction in the air pull of gas-engines, very satisfactory results were obtained at a calorific value varying from 350 to 360 B.Th.U. per cubic foot.

Fortunately the Johnstone gas undertaking was able throughout the strike, with the exception of four weeks, to maintain full pressure, which, being as high as 5-in. water-gauge in some of the upper areas, greatly added to the comfort of both producer and consumer.

Analyses of the gas were taken daily by means of an Orsat apparatus and a Hempel explosion pipette; and the average of the results over the week, taken from the laboratory note-book, was as follows:

	P.Ct.
Carbon dioxide	7·40
Oxygen	0·30
Unsaturated hydrocarbons	1·40
Carbon monoxide	11·00
Methane	16·64
Hydrogen	29·76
Nitrogen	33·00
	100·00

CALORIFIC VALUE (by calculation).

	P.Ct.		
Unsaturated hydrocarbons	1·4 × 2660 =	3,724	B.Th.U.
Carbon monoxide	11·0 × 325 =	3,575	,,
Methane	16·64 × 1024 =	17,039	,,
Hydrogen	29·77 × 342 =	10,178	,,
Calorific value		345·16	B.Th.U.

These tests were taken from a pipe connected to the outlet of the gasholder, and were carried through twice daily, and provided a check upon the calorific value found by the Simmance-Abady "Total Heat" calorimeter. The average calorific value for the week, testing by means of this apparatus, was found to be 350·14 B.Th.U. A recording calograph, set in accordance with the results obtained from the calorimeter, kept the stokers right; and inspection of this was made by them every thirty minutes.

Considering the scope the gas engineer has had during these past months for experimenting in low-grade gas, and the results obtained therefrom, I think I am safe in saying that, with the necessary initial pressure at hand, very few will willingly resort to the old-time calorific value of 500 to 600 B.Th.U., especially now that the foreword in all forms of industry is economy. The new conditions placed upon the industry by the Gas Regulation Act, and especially the later decisions regarding the percentage of carbon monoxide and inerts, will enable gas undertakings to declare that value of gas which is found most suitable to the needs of their consumers, and, as in every given case, the price will be less with a lower thermal yield per 1000 c.ft. It will be interesting to notice how far the increased carbonizing efficiencies which will follow will reduce the price of the therm itself.

The coke produced reminded one of blast-furnace coke, though not so dense. The slatey grey, close-grained, homogeneous body all spoke for high carbon content; and in analysis that property, along with low ash and moisture content, foretold excellent results in producers. An average sample is here noted:

	As Fired. P.Ct.	Dry. P.Ct.
Fixed carbon	84·90	86·24
Volatile matter	—	—
Ash	13·14	13·34
Sulphur	0·41	0·42
Moisture	1·55	—
	100·00	100·00
Nitrogen	1·65	1·68

Bakers complained, however, of their inability to obtain the necessary quick, sharp heat which they required. The long duration charges and the high density of the coke both combined to make this not so acceptable as one would have thought likely. It evidently was more "dour" than Scotch coke. It proved excellent for the producer, although the steam supply had to be increased very appreciably. Otherwise the removal of clinker would have been rather difficult, as considerably more trouble was experienced, even with the increased steam supply, in getting it clear of the sides and back of the producer. With the large carbon content of the coke and additional steam, the yield of carbon monoxide gas was naturally greatly increased, and an increase of secondary air was required before the heats were brought up to their highest point of efficiency. The liquid products showed up well, and analyses of these are also given.

Ammoniacal Liquor.

In the liquor yield the figure, 101 gallons per ton of coal, shown in the details of the week's test appears disproportionate, but is compensated for by the low ammonia content per gallon. The chief cause of the abnormal gallonage was the necessity for maintaining a small constant flow of water passing through the hydraulic main. With the long duration charges, high heats, and limited condensing plant, it was found impractical to work without this stream of water. In attempting to do so, difficulty was experienced in keeping the main clear of hard, pitchy matter, which originated in the coal dust being carried over from the retort at each period of charging, and threatened at times to choke both dip-pipes and tar overflow.

Tar.

Specific gravity . . 1 609
Free Carbon Content 2·090 p.t. (by weight).

First distillate up to 170° C. (338° Fahr.)	By Weight.	By Volume.	
—Water	12·0 p.ct.	11·2 p.ct.	
First light oils	6·9 ,,	5·1 ,,	S.G. equals 8905
Second distillate up to 230°C. (446° Fahr.)			
Second light oils	16·2 ,,	15 6 ,,	S.G. ,, ·9793
Third distillate up to 270° C. (518° Fahr.)			
—Creosote oils	8·2 ,,	7·6 ,,	S.G. ,, 1 0042
Fourth distillate up to 310° C. (590° Fahr.)			
—Anthracite oils	10·9 ,,	9 9 ,,	S.G. ,, 1·046
Fifth Distillate—			
Oils above 310° C.	12·3 ,,	11·1 ,,	S.G. ,, 1·070
Pitch (soft)	32·7 ,,		
Loss	0·8 ,,		
Total	100·00		

The result of an analysis of a sample of this liquor taken from the catch-pot was as follows:

	P.Ct.	Lbs. per Gallon.	
Free ammonia	0·850	0·0850	equals 91 69 p.ct. NH_3.
Fixed ammonia	0·077	0·0077	,, 8 31 ,, ,,
	0·927	0·0927	,, 100·00 ,, ,,

Twaddel strength equals 2·5°.
Ounce ,, ,, 4·27°.

Sulphate of ammonia yield per 100 gallons equals 37·87 lbs. of 24½ p.ct. ammonia.

Gallons required per ton equals 5914 gallons per ton of 24½ p.ct. sulphate of ammonia.

Periodic pyrometric tests were taken and were found very uniform throughout, allowing for the fact that the setting of retorts happened to be the one next to the end wall of the bench, and the heats on one side were not quite so high as on the other. A Cambridge and Paul thermo-electric pyrometer was used; and the average registrations for the week are given in Centigrade and Fahrenheit:

Setting of Six Retorts.

Flues 9 Ft. from Top of Retort.

No. 1.	No. 2.	No. 3.	No. 4.
1170° C. ..	1150° C. ..	1100° C. ..	1050° C.
2138° Fahr. ..	2102° Fahr. ..	2012° Fahr. ..	1922° Fahr.

Flues 3 Ft. from Bottom of Retort.

No. 1.	No. 2.	No. 3.	No. 4.
980° C. ..	1000° C. ..	1010° C. ..	850° C.
1796° Fahr. ..	1832° Fahr. ..	1850° Fahr. ..	1562° Fahr.

The average result of the analyses taken of the flue gases before leaving the bottom of the retort was as follows:

Carbon dioxide	19·7 p.ct.
Oxygen	0·2 ,,
Carbon monoxide	*Nil*

The method adopted was that of drawing the gas from the flue through a long perforated pipe by means of two aspirating tins, one of which was filled with water saturated with carbon dioxide. Tests of the flue gases were generally carried out from the contents of the tin, but occasionally were checked by tests on the bench immediately after drawing a suitable sample; and the results agreed consistently.

The gas and residual yields of the complete test were as follows:

Gas made for the week	1,570,800 c.ft.
Coal used for the week	59 tons 18 cwt.
Gas made per ton of coal	26,223 c.ft.
Total coke yield	31 tons 8 cwt.
Per ton of coal carbonized	10·48 cwt.
Coke used in producers	8 tons 7 cwt.
Per ton of coal carbonized	2·79 cwt.
Coke sold over steelyard	23 tons 1 cwt.
Per ton of coal carbonized	7·69 cwt.
Tar made per ton of coal	19·5 gallons.
Ammoniacal liquor ,,	101 gallons.
Average calorific value of gas—	
By calorimeter	350·14 B.Th.U.
By analysis	345·16 B.Th.U.

Note.—The works boiler was employed during the period of the test for the working of the scrubber, exhauster, producers, hydraulic and ammoniacal liquor pump, sulphate of ammonia plant, and the steaming of the coal charge.

Coal dross, coke riddlings, and breeze to the amount of 10 tons 5 cwt. were used, which, on a financial balance-sheet, requires to be deducted from the 23 tons 1 cwt. of coke sold. The calorific value of this dross was not tested, but could not have exceeded 10,500 B.Th.U. per lb.

I do not suppose that the need for using American gas coal in the British gas industry will ever become common; but I am of opinion that, apart from prohibitive price, it is a most interesting coal to work, and the recent experience must have brought home

to many gas managers in this district the fact that the home product does not compare well with it. The immediate need for it has passed, and it may be soon forgotten. This paper, therefore, will only be of use in so far as it deals with the methods adopted to obtain the highest possible efficiency from the plant we may each have at our disposal, and these methods are necessary whether the coal be home or foreign.

I have no doubt some of you will have noticed points upon which I may have dealt more fully than their importance to you seems to deserve, while others may have noticed promising channels along which I have not ventured at all. These, however, will doubtless come out in the discussion.

DISCUSSION.

Mr. JOHN M'ISAAC (Glasgow) remarked that the paper was a distinctly informative one; but it seemed to him its value in the "Transactions" would be enhanced if Mr. Sim could furnish a few more supplementary details as to the reduction of the air-pull of gas-engines. For instance, it would be interesting to know if, consequent upon the reduction in the air-pull of gas-engines, there had generally been any complaints locally relative to increased gas consumption. He had been much struck with the reference in the paper to the fact that bakers in Johnstone had complained of their inability to secure the quick, sharp heat, which was a factor both necessary and desirable in their daily operations. It seemed to him as if what was wanted to get rid of this objection was a forced draught. His contention on the point was borne out by a subsequent paragraph in the paper, where Mr. Sim represented that "the coke proved excellent for the producer, although the steam supply had to be improved very appreciably."

Mr. WALTER M. PATERSON (Glasgow) testified to the good make of gas it was possible to obtain from American coal in horizontal retorts.

A MEMBER quoted statistics to show that at the Greenock gas-works results were obtained very much similar to those mentioned by Mr. Sim as having been recorded at Johnstone.

Mr. JOHN M'INTYRE (Glasgow) enumerated a few of the general difficulties associated with the carbonization of American coal; but, like the others, his observations were of a favourable nature.

Mr. BELL (Dumbarton) intimated that, so far as his experience with American coal had gone, it bore out in great measure all that Mr. Sim had represented in the course of his paper.

It was arranged that, if necessary, additional points emerging from the paper should be discussed at a subsequent meeting.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Visit to the Cupar Gas-Works.

A large number of members of the Association availed themselves last Saturday week of the opportunity of visiting the Cupar Gas-Works, where a highly instructive afternoon was spent.

The visitors were received by Hon. Sheriff Substitute Honeyman (Chairman), and Mr. J. M'Pherson (Engineer and Manager) of the Cupar Gas Company. Messrs. Beale and W. Dawes, of the Woodall-Duckham Company, assisted Mr. M'Pherson in the tour of inspection of the works; and the setting of Woodall-Duckham vertical retorts was an object of much interest. Every detail of the working was carefully explained by these gentlemen; and Mr. M'Pherson is to be complimented on the excellent system on which he works. After the inspection, the company were entertained at tea—Mr. Honeyman presiding.

Mr. M'PHERSON subsequently gave a *résumé* of six years' working of Woodall-Duckham vertical retorts. The setting was started on Feb. 12, 1916, and since that time has carbonized 11,158 tons of coal, equal to 3000 tons per retort. It was not until 1917 that steaming was extensively carried out. The make per ton then rose from 11,700 c.ft. until to-day 19,500 c.ft. of 425 B.Th.U. gas per ton is made. The retorts themselves show little signs of wear and tear; and it is estimated that they are good for another two to three years' working. For the benefit of the members, Mr. M'Pherson had made inquiries regarding renewals of brickwork, and found that £1000 would be necessary to renew the retorts from the bottom castings upwards, and to re-line the producer. To renew from 10 ft. to 12 ft. down and re-line the producer, would require about £450. He is in the happy position that he has spent nothing on renewals for six years. He pointed out that to renew a bed of six horizontal retorts at the present time would cost approximately £300.

The make per retort for 24 hours has reached as high as 67,000 c.ft. with steaming, and 48,000 c.ft. on straight gas. The yield of coke per ton of coal is 13 cwt.; but a varying proportion of this figure has to be deducted for coke used on the producer. Deducting, further, the coke used under the boiler, he gives the figure of 4 to 5 cwt. for sale per ton of coal carbonized.

The producer is of the water-pan type, requiring clinkering only once a week, and pricking-up once daily. Any clinker which forms can be easily picked-off. He attributes this to the fact that the primary air is first passed over the water-pans, gathering steam from there, and is introduced into the producer in a moistened state. He is confident that this is a much better way than in the latest step-grate type of producer, where the primary air is cold, and enters the producer through the slides of the front door.

Mr. M'Pherson has made a special study of superheating steam for the retorts, and has hit upon a very successful plan with which the steam at 10 to 15 lbs. pressure has a double run through the waste-gas flues on both sides of the retort, and is then introduced through a vent in the manhole in the top casting of the bottom ironwork of the retort. The steam thus enters immediately behind the hangers which form part of the extracting device. The superheater is simple, and consists of a 3-in. cast-iron pipe, inside which is a return length of ½-in. wrought-iron steam tube. He was able to show the members lengths of both pipes which had been in use for nearly four years, and were practically sound. The temperature of the steam entering the retort is never under 850°; but he aims at even a higher temperature. The yield of sulphate of ammonia is 22½ lbs., and tar 22 gallons, per ton of coal carbonized. The coal used is mostly drawn from Lanarkshire, which he finds better in all respects than that of Fifeshire. In the works, annular condensers are in use, a Livesey washer, four water-lute purifiers, and a Bryan Donkin exhauster of 20,000 c.ft. capacity, with a Waller stand-by of 15,000 c.ft. There is employed one man per shift on the verticals; and he has a little assistance when clinkering the producer. Mr. M'Pherson estimates the figure at 2¾d. per 1000 c.ft. made as wages from coal store to coke yard.

Mr. M'DONALD (Prestonpans), the President, in moving a hearty vote of thanks to Mr. M'Pherson for his valuable contribution, said they were highly indebted to the Cupar Gas Company and to the Manager for their hospitality that day.

Mr. JAMES CAMPBELL (Dunfermline) said he was sure the junior members, in going over the works, had seen something which would guide them, and be an example of how the plant of a gas-works should be kept.

In the course of a long discussion, many questions were answered, and interesting facts and figures given. The chief points of interest were the following.

Mr. M'PHERSON, in reply to Mr. Dearden, said there was no steam supply on the producer, only what came off the water channels. They used nothing but screened coke. The original bars were still in the producer, and had required no attention, beyond new slots being bored in the far-end. The dust nuisance was not so acute as from the new step-grate producer.

Mr. DEARDEN suggested the importance of a jigging screen to separate the small coke on its way to the producer, in a big installation where conveyors were used.

Mr. BEALE said that it would be necessary to have this arrangement before the coke left the ground floor, as more work would be required to get the breeze and small coke down from the overhead bunkers.

Mr. M'DONALD (Kirkcaldy) was strong on the B.Th.U. question, and maintained that a gas of 425 B.Th.U. was, from both the manufacturer's and consumer's point of view, as good as one of 600.

Mr. R. L. LAING (Brechin) asked if all the increases in gas sold shown by the various companies were actual new business. In a recent paper he had seen that various accounts were down in consumption with a low-grade gas. As to Woodall-Duckham retorts, in Brechin they had an arrangement by which the man in charge could see exactly how the retorts were running without climbing the stairs every hour. A brass chain connected to the chain pulleys on the auxiliary hoppers, and led down to the ground floor, proved an admirable arrangement. With a small unit such as at Cupar or Brechin, it was a necessity that a steady quality of gas be obtained. With one retort out of two or three working slow or fast, the quality of the gas jumped up or down.

Mr. D. MORTON (Kinross) asked for information about distribution expenses in connection with supplying a low-grade gas—whether the meters gave any trouble, and what steps were taken to adjust consumers' appliances.

Mr. M'PHERSON was able to assure him that he gradually brought his gas down to the present calorific value—not at one jump. The invention of Mr. P. S. Hoyte, of the Plymouth Gas-Works—a small wire cone—proved the most suitable for adjusting appliances; and only during the coal strike, when the gas was of necessity reduced as low as 350 B.Th.U., were there many complaints.

The PRESIDENT, who supplies low-grade gas, said he had tried the springs mentioned, and clips and gas adjusters, but found that increasing the size of the nipples on cookers and rings was most satisfactory.

Many other matters concerning low-grade gas and vertical retorts were under discussion.

Maximum Increase at Swadlincote.—It was reported at a meeting of the Swadlincote Urban District Council that the Board of Trade had intimated that the maximum increase in the price of gas that could be authorized by them under an Order was 50 p.ct. over and above the prices permitted by the Local Act; and that the application had been amended accordingly. The figures of 6s. 9d. and 7s. 6d. have been substituted for the 7s. 6d. and 8s. per 1000 c.ft respectively mentioned in the original application.

Redcar and the Therm Basis.—The Board of Trade have authorized the Redcar Urban District Council to charge 1s. 6d. per therm for gas. The Council's first year's working with the gas undertaking has been trying; the stoppages due to the miners' dispute having had rather a disastrous effect. The Marske and Saltburn authorities, who had protested that the amount charged should be less than 1s. 6d. per therm, did not carry their protests to the inquiry in London, at which Redcar put forward its claim that the amount proposed was fair and reasonable.

The Proposed Extensions at Barry.—A letter from the Property Owners and Ratepayers' Association was read at a meeting of the Barry Urban District Council last week, protesting against the proposal to spend £125,000 on extensions at the gas-works, and asking for details of the scheme, in order that the Association might obtain expert engineering advice with a view to the installation of electricity. A motion to defer proceeding with the gas-works extensions until a conference had taken place with the Association as to electricity was, however, defeated.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Steaming in Vertical Retorts.

SIR,—Engineers and other responsible officials of gas undertakings who are seeking the most economical method of producing gaseous therms undiluted with heavy, bulky, and useless inert gases must be gratified to observe the great care and trouble bestowed by Sir George Beilby and his staff of able assistants in clearing-up points which, in the absence of explanation, might obscure the full value of the work done and reported upon.

The graphs and tables embodied in the report submitted as a paper to the Institution meeting in October, constitute a useful guide, within the limits of practical steaming, to anyone having, or proposing to have, suitable vertical settings, and anxious to discover the most economic basis for producing the quality of gas suited to local conditions.

It is not my intention, at this stage, to continue the discussion on the conditions necessary in the retorts for the production of the maximum quantity of ammonia, and similar subjects; but I would like to express my thanks to Commander J. Fraser Shaw for the interesting and useful exposition of the tables and graphs given in the current issue of the "JOURNAL."

There still remains great scope for investigation by the Institution's Research Committee with the valuable backing of the Leeds University, by individual works having sufficiently trained chemists, and not least by the Fuel Research Board with the unique facilities and resources at their command. It was for many years felt to be desirable that the gas industry as a whole should possess an experimental works—this has now been provided by the State in recognition of the important place which the supply of gas and products has taken in recent years in conserving coal, and by contributing in a substantial way to the supply of smokeless fuel (gaseous and solid), and oils and chemicals, all of which are of national importance.

Let us see to it that the investigations carried out at the Fuel Research Station are fully appreciated by the industry to whose success the work done will contribute in no small degree.

THOS. GLOVER.

Norwich, Nov. 17, 1921.

Chesterfield Gas-Works Management.

SIR,—With reference to the paragraph on my retirement, published in your last issue [p. 486], I have to say that I was not retained as consulting engineer, but that my services should be at the disposal of the Gas Committee should they be at any time required.

I think this explanation is only due to Mr. Davies, who is Engineer and Manager.

W. J. BUCKLAND.

Gas Works, Chesterfield, Nov. 17, 1921.

Running a Gas-Works on All-Tully Gas.

SIR,—With reference to your editorial on my address at the Scottish Junior Gas Association, as reported in the "JOURNAL" for Nov. 9 [p. 440]. As I do not have a calorimeter or a photometer, I cannot give the candle power or calorific value. The only further information I can give is that, at the pressure and consumption stated, I had a full and brilliantly illuminated mantle.

For the boiling tests, I used an ordinary enamelled domestic pot, with lid. The starting temperature was 56° Fahr.; and the pot contained 1 quart (= 2½ lbs.) of water. The quart of water filled the pot to within ½ in. from the top; and I assumed it boiling when the lid began to lift. In one of the tests you will notice only 2·48 c.ft. was used. An engineer from the North of England who visited the works lately stated, at an Association meeting, that after leaving Prestonpans he passed through two districts where the gas was known to be between 450 and 500 B.Th.U., and, as far as street lighting was concerned, the lighting in the low calorific power district was as good as the other.

To bear out my claim as to the economy of the gas, I may state that the headmaster of the evening school here tells me that last year he required eight burners to illuminate the class-rooms (and they were badly lit at that), while this year four burners are doing the work. As I stated in my paper, an eminent Scottish gas engineer and chemist have been engaged to investigate this method of manufacture and distribution; and I have no doubt the work will be made public when completed.

A. M'DONALD.

Gas Works, Prestonpans, Nov 15, 1921.

Hopes of Cheaper Gas in Manchester.—The Chairman of the Manchester Gas Committee (Alderman W. Kay) is reported to have expressed the opinion that there is every possibility of the price of gas supplied by the Corporation being lowered in the near future. On Dec. 31 the Committee will take over the Stretford and Urmston areas; and arrangements have been made for improving the supply in these districts, especially to the new houses.

Nantwich Gas Charges.—At a meeting of the Nantwich Rural Council last week, a letter was received from the Board of Trade with reference to an application from the Nantwich Urban Council for an Order to allow a temporary increase of gas charges to 7s. per 1000 c.ft., to enable the Council to carry on the gas undertaking; the Board stating that an Order had been made for the Council to make this charge. The Clerk intimated that the Urban Council agreed to fix the maximum at 7s.; and the Rural Council had withdrawn their opposition to the Order. Mr. S. Jackson said the Nantwich Gas Committee had no difficulty in showing that the increased price was necessary, in view of the higher cost of production, capital charges, &c. It was explained that the increased charge was only to be made until the gas undertaking was in a better position.

REGISTER OF PATENTS.

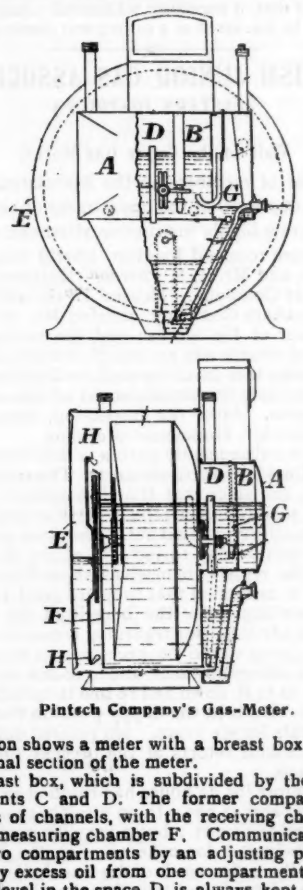
Gas-Meters.—No. 147,691.

JULIUS PINTSCH, AKTIENGESELLSCHAFT, of Berlin.

No. 19,677; July 8, 1920. Convention date, Sept. 20, 1916.

The patentees thus refer to their invention: In gas-meters of the kind having an oil-charge, the disadvantage has been experienced that the oil increases in volume owing to its taking-up the chemical ingredients contained in the gas, until saturation takes place, and also that, on the other hand, it diminishes in volume after a time owing to vaporization. The increase of volume of the oil, on the one hand, reduces the available space in the measuring chamber, thus prejudicing the consumer; while the disadvantage may occur that the oil closes the overflow as well as the gas-inlet, so that the operation of the meter is entirely stopped. The vaporization of the oil-charge increases the cubical content of the measuring chamber, which results in prejudice to the gas producer. In oil-charged gas-meters, therefore, it has been considered necessary to use an oil of specific chemical properties, in order to obviate increase in volume as far as possible. Further, the vaporization of the oil, which takes place in time, has not been compensated; so that frequent recharging is required. It has been proposed in the case of wet gas-meters having a water-charge to provide a storage receptacle or a scooping device in order that the level of the charge may be kept automatically at a constant height. But in these meters, no care is taken to avoid the disadvantages referred to.

The present invention comprises a wet gas-meter with an oil-charge; and the arrangement is such that not only on the expansion of the charge, but also on vaporization, the level of the charge in the measuring chamber is always maintained at a constant height, thus enabling an oil of no particular chemical properties to be used. In order to attain the object in view, the breast box of the meter is subdivided into two compartments—one of which communicates with the receiving chamber and the other with the measuring chamber. The two compartments are in communication by means of an overflow pipe, so that if the oil in the measuring chamber increases in volume it may flow into the second compartment, which communicates with the receiving chamber. The oil scooped in excess into the measuring chamber is passed by the overflow pipe into the space in the breast box, and thence into the receiving chamber.



Pintsch Company's Gas-Meter.

The illustration shows a meter with a breast box (partly in section) and a longitudinal section of the meter.

A is the breast box, which is subdivided by the partition B into the compartments C and D. The former compartment communicates, by means of channels, with the receiving chamber E, and the latter with the measuring chamber F. Communication is established between the two compartments by an adjusting pipe G. This pipe serves to convey excess oil from one compartment to the other; so that the liquid level in the space D is always kept constant. H is a scooping device located in the chamber E and driven by the measuring drum. It scoops liquid during the operation of the meter into the measuring chamber, so that (even if the oil vaporizes) the level of it is always kept constant.

Measuring the Quantity of Flowing Gases.

No. 147,892.

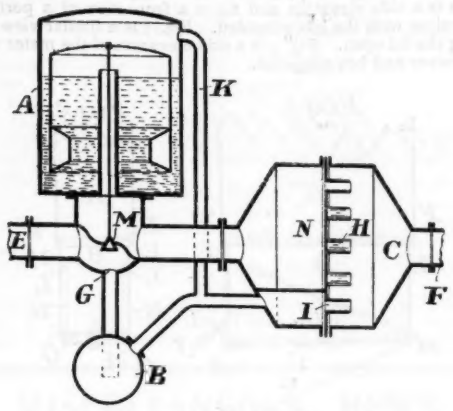
JULIUS PINTSCH, AKTIENGESELLSCHAFT, of Berlin.

No. 19,944; July 9, 1920. Convention date, Aug. 16, 1915.

The patentees state in the course of this specification: The most used devices for measuring the quantity of flowing gases are the well-known wet and dry gas-meters. In order to obtain smaller dimen-

sions, so-called proportional gas-meters have been employed. The exactness of the measuring is well known to be smaller the greater the fluctuations of the gas quantity flowing through, and of the gas pressure. Besides the fact that the quantity ratio of the two gas streams *per se* is not equal, and does not remain equal, to the proportion of the pipe cross sections, a drop of pressure, which varies according to the quantity of the gas passing through, is caused by the meter provided in the part-stream without a similarly variable resistance being present in the main gas stream.

This new apparatus is based upon the consideration that the meter, constantly and under all changes of quantity and pressure, shows the "proper part amount" if it is arranged in one of several equal part streams into which the main gas stream is subdivided, and if at the same time use is made of an automatic pressure regulator to maintain the pressure in front of, and behind, all the nozzles through which the subdivided branches of the main stream flow respectively equal to the pressure in front of, and behind, the nozzle through which passes the gas which has been measured.



Julius Pintsch's Proportional Gas-Meter.

The illustration shows one form of the apparatus.

The gas enters at E and passes through a casing C, having a series of equal parallel pipes, holes, or nozzles H, arranged in an intermediate wall. A pressure regulator A is provided; the weight of the regulator bell being balanced by a float. The purpose of the regulator is to reduce the pressure of the entering gases by an amount equal to the drop of pressure caused by the small meter B according to the quantity of gas passing through.

Before the reduction of the pressure, a part gas stream is branched off at G, the quantity of which is indicated by the meter B. This part-stream then passes through a single separated nozzle I in the casing C, and is combined again with the other gas streams behind this nozzle. The space above the regulator bell is connected by a pipe K to the exit of the meter. The throttle valve M of the regulator is, therefore, acted upon by the pressure in front of the nozzles H as well as by the pressure in front of the single nozzle I.

If the quantity of gas passing through should increase, the regulator bell will be lowered, and the valve M further opened. As, however, the meter B also allows a greater quantity of gas to pass through it, its consumption of pressure is increased on account of an increased number of revolutions. The pressure behind the meter will cause the valve M to be further opened only to such an extent that the same pressure will exist again in the space N as at the exit of the meter and in front of the nozzle I. On a decrease in the gas consumption, the operation described will be reversed.

The regulator bell will only be in equilibrium and at rest as long as equal pressures exist inside and outside. If this desired equality of pressure is destroyed by a variation in the gas consumption or in the initial pressure, a new adjustment of the valve M will take place until the pressures prevailing in front of the nozzles H and the front of the single nozzle I are again equal to one another. As the pressure behind the nozzles is necessarily equal, the nozzle I always allows the same quantity of gas registered by the meter to pass through as does each of the other nozzles H.

The registration of the meter need only be multiplied by the number of nozzles used in order to obtain the complete quantity of gas passed through, which may, of course, also be registered directly by the counter of the meter.

The number of the nozzles need not be greater than two, in which case it is only necessary to take care that, in contradistinction to ordinary proportional meters, both branches are of the same size. If the number increases, the size of the meter is reduced.

In the measuring pipe proper, several nozzles which are separated from the others and are even of different sizes may be arranged, if only the numerical ratio between the sizes of the separate nozzles in the measuring stream and those of the main stream remains the same. The arrangement of nozzles equal to each other is, however, to be preferred, so that the gas under the different velocities of passage and the prevailing pressure always encounters the same resistance in all the passages.

Gas-Meters.—No. 148,200.

JULIUS PINTSCH, AKTIENGESELLSCHAFT, of Berlin.

No. 20,121; July 9, 1920. Convention date June 8, 1917.

This invention relates to a modification of the gas-meter forming the subject of patent No. 147,691 (*supra*); and it has for its object to remove certain disadvantages which may be met with if the meter is not properly handled.

It may sometimes happen that, after the meter has been charged and the screw-plug inserted, the level of the liquid in the receiving chamber is inadvertently left unadjusted. In such case this would, on the one hand, mean a decrease in the measuring space, while, on the other hand, there would be the danger that on an increase of the charge the excess would be able to flow into and fill the sump entirely, and then rise so far that the inlet-pipe would be closed and no gas pass through the meter. The present invention obviates this disadvantage.

Measuring the Quantities of Flowing Gases. No. 148,566.

JULIUS PINTSCH, AKTIENGESELLSCHAFT, of Berlin.

No. 20,569; July 10, 1920. Convention date, Oct. 25, 1916.

This invention is a modification of patent No. 147,892 (*supra*).

The earlier patent was characterized by the feature that the main gas stream was subdivided into any number of streams which flow through nozzles equal to each other, and only the quantity of gas passing through one of the nozzles was ascertained by a quantity meter. But according to the present invention, in place of the comparatively expensive automatic regulator described, there is employed a throttling device, such as a sliding-valve, a lift valve, a throttle, or similar device; and the main current of gas is intended to be throttled by hand down to the pressure which exists in the shunt current behind the part current meter. The adjustment of the throttling is to be done once at a mean velocity of the gas.

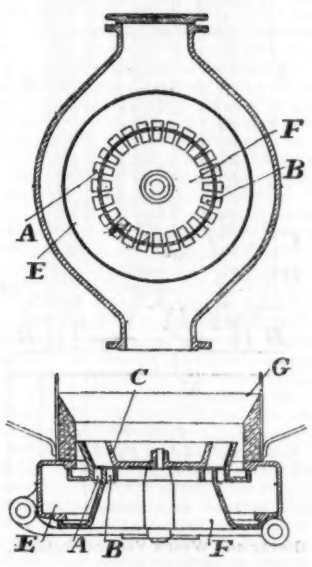
Gas-Burners for Heating Furnaces.—No. 153,897.

EICKWORTH, R., of Dortmund, Germany.

No. 30,526; Oct. 28, 1920. Convention date, Nov. 11, 1919.

In gas-burners for heating furnaces hitherto known, the patentee remarks, it has been proposed to employ a turbine wheel rotating in front of air and gas nozzles arranged in the form of a ring behind two concentric vane rings. Burners are also known wherein gas and air have been mixed by a turbine wheel, and then conducted into a combustion chamber. Further, it has been proposed in incandescent gas-lamps to supply gas through annular orifices drawing in air through central tubes in such orifices—the air and gas mixture being delivered to a chamber in which a fan rotates for effecting more thorough mixing. According to the present invention, on the other hand, gas and air nozzles are arranged beside a turbine wheel having inclined blades adapted to exert an impelling action on the gas, or to be rotated by the gas under pressure impinging thereon—the turbine wheel passing closely over the outlets of the air and gas nozzles so that it takes up definite amounts of gas and air into the spaces between the blades as these pass over the outlets of the nozzles, and so gives an accurate and constant gas mixture through the action of the turbine wheel. At the same time the outflow speed of the mixture can be maintained higher than the speed of combustion through the gas, so that no striking-back of a flame through the gas mixture in the blades can take place.

The gas and air nozzles may be grouped in various ways relatively to the turbine wheel. They may be arranged in concentric circles side by side behind the turbine wheel, or one above another at the side of the turbine wheel. The best distribution of the gas and air within the turbine wheel occurs when the nozzles are alternately one behind another in a circle behind the turbine wheel, so that each vane passes in succession over an air-nozzle and a gas-nozzle alternately.



Eickworth's Gas-Furnace Burner.

A number of constructional forms of the burner are illustrated in the specification. In that here shown, the gas-nozzles A and the air-nozzles B are arranged side by side in two concentric circles behind the turbine wheel C rotatably mounted on a shaft. The gas flows from the chamber E and the air from the chamber F, through the nozzles into the turbine wheel, so that between the separate vanes there already exists a gas-air mixture, and gas and air are thus passed

in very intimate admixture into the combustion space G by the turbine wheel, which may be driven by any suitable motor and serve to draw in both the gas and the air. The turbine wheel may also be driven by the pressure of the gas or air.

Gas-Burners for Heating Furnaces.—No. 157,880.

EICKWORTH, R., of Dortmund, Germany.

No. 30,527; Oct. 28, 1920. Convention date, Jan. 16, 1920.

This invention relates to improvements in, or modifications of, the furnace gas-burner described in patent No. 153,897 (*supra*).

It has been suggested previously to mix gas and air by means of a fan, and then to conduct the mixture into a combustion chamber—the fan, when compressed air was available, having been rotated by passing the compressed air through nozzles in the periphery of the fan casing while the gas entered through central apertures.

In the burner forming the subject of the parent application, the turbine wheel, which rotates with its blades passing closely over the air and gas outlets, is driven either by a separate motor or by the action thereon of the gas or of the air for combustion when supplied under pressure. But according to the present invention, the turbine wheel is driven by air under pressure supplied to one or more nozzles, directed so as to cause an air jet or jets to impinge on the turbine wheel and to drive it—drawing into the spaces between the turbine blades the gas and the principal part of the air required for forming the combustible mixture. In this manner it is possible to drive the turbine wheel by means of air supplied under pressure in small quantity through a small pipe, while all the rest of the air for combustion is drawn in freely from the outer air. At the same time the advantages of the construction according to the parent application (particularly the accurate proportioning and mixing of the gas and air by the turbine wheel) are retained.

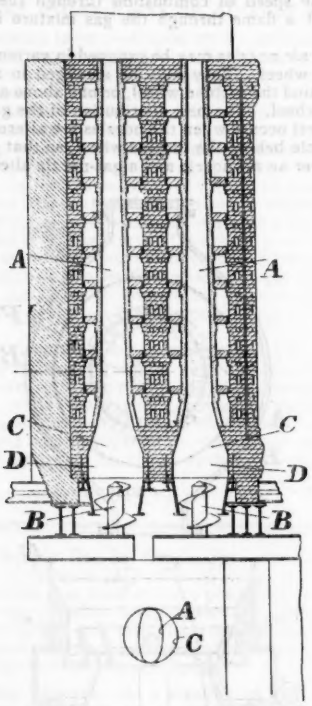
Vertical Retorts.—No. 170,197.

GLOVER, S., of St. Helens, WEST, J., of Southport, and WEST'S GAS IMPROVEMENT COMPANY, LTD., of Manchester.

No. 29,307; Oct. 16, 1921.

This invention relates more particularly to vertical retorts in which steam is admitted for the production of water gas; and its object is "to ensure that the incandescent coke adjacent to the point where the steam is injected into the retort shall be in a form to ensure the rapid conversion of the steam into water gas."

The invention comprises the combination with a vertical retort and with a worm extractor adapted to support the charge in the retort, of a chamber (between the worm and the base of the retort proper) of larger sectional plan than the retort, so that the lateral support of the coke from the retort is withdrawn, allowing the action of the rotating extractor to deflect and split-up in the chamber the coke leaving the retort.



Glover and West's Vertical Retorts.

In accordance with the illustration, the base of each retort is gradually widened at its lower end, and between the end and the worm extractor B, by which the coke is discharged into the coke hopper [not shown], is a chamber C, which widens gradually from the bottom of the retort till it assumes the circular form of the part D where the upper end of the extractor operates, "thereby giving a much larger area for the distribution of the incandescent coke for the proper and efficient production of water gas from steam injected into the coke."

The coke issuing from the retort, and supported at the base by the head of the extractor, has its lateral support removed, and is said to be deflected and evenly distributed in the widened extension chamber due to the action of the extractor as it rotates—the coke being rather brittle at this stage. The enlarged part of the retort with its extension is, therefore, filled with lumps of incandescent coke of such dimensions that the steam injected into the coke-hopper or into the chamber adjacent to the extractor is brought into intimate contact with it, and has "a very tortuous path as it travels upwards into the retort proper."

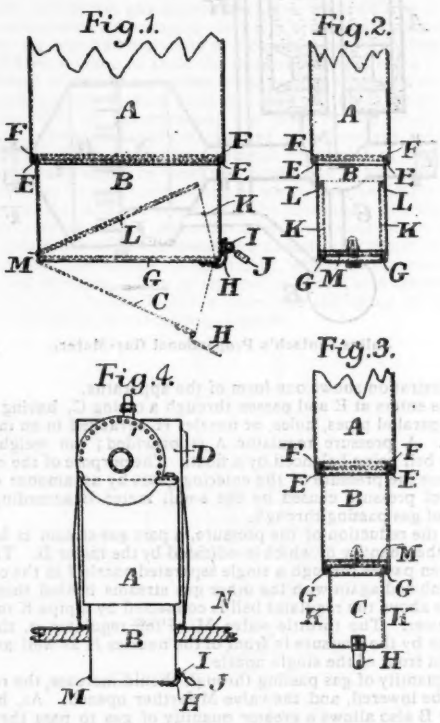
Coin-Freed Gas-Meters.—No. 170,486.

GLOVER, W. R., and WHIMSTER, J. I., of Edmonton.

No. 27,989; Oct. 2, 1920.

The object of this invention is to construct the coin receiver or box of the meter of greater capacity without altering the width of the meter or interfering with any of the working parts.

Fig. 1 is a side elevation and fig. 2 a front view of a portion of a coin-receiver with the box extended. Fig. 3 is a similar view to fig. 2 showing the lid open. Fig. 4 is a side elevation of the meter with the coin-receiver and box extended.



Glover and Whimster's Coin-Freed Meters.

The coin-receiver or box casing A is made with an open bottom, and in this is fitted a box B having an open top and a hinged bottom C—the box being capable of telescoping in the other or fixed casing, so that when the meter D is not connected-up the collapsible portion can be pushed into the casing A, keeping the meter the ordinary size; but when the meter is fixed for use, the box is pulled down to depend below the casing, thereby with the fixed casing forming a receiver capable of holding a greater number of coins than at present.

The casing is made preferably oblong, with an open bottom having its bottom edge E curled or beaded inside to form a ledge. The collapsible portion B fits inside the casing, and its top edge is provided with a curl or bead F on the outside to form a ledge, so that it will engage the inside bead E of the casing and thereby retain it when pulled fully down.

The bottom of the box B is provided with beads or curls G on the inner edges on opposite sides, and with a door C hinged at one end to the bottom B, and provided at the front with a hasp H for engaging a staple I on the collapsible box B, whereby it can be locked to it by a padlock J. The side edges of the door are provided with walls K, each having an outward bead or curl L on the free edges, so that when the door is pulled down on its hinge pin M the beads or curls engage the beads or curls on the bottom side edges of the collapsible box, and the door is prevented from being fully opened, remaining on the slope (as dotted lines fig. 1) with an open end at the end opposite the hinge M, through which the coins can readily slide or be removed.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 16.]

Nos. 29,543 to 30,265.

BECKER, J.—"Coking retort ovens." No. 29,644.
BRÖCKER, H.—"Gas-generating apparatus." No. 29,879.
DARRAH, E.—"Geysers, &c." No. 29,925.
FAIRWEATHER, C.—"Gas meters." No. 30,060.
FAURE, J. M. A.—"System for distributing gas or liquids under pressure." No. 29,996.

FOURNESS MANUFACTURING CO., LTD.—See Darrah, E. No. 29,925.
GARNER, TELFORD, AND HARDMAN, LTD.—"Charging valves or doors for furnaces, gas-retorts, &c." No. 30,097.
GLOVER, G., AND CO., LTD.—"Prepayment meters." No. 29,849.
GOULD, F. J.—"Injectors for incandescent gas-burners." No. 29,657.
HARDMAN, J. H.—See Garner, Telford, and Hardman, Ltd. No. 30,097.
HAYES, H. H.—"Burners and burner fittings." No. 29,819.
HAYNES, H.—"Protectors for gas-mantles." No. 29,651.
HUMPHRIES, H. B. P.—"Means for promoting heat exchange between gases and liquids." No. 29,958.
KARLSON, A.—"Hot-plate for use with gas-stoves, &c." No. 29,934.
KERR, A. C.—"Pipe joints." No. 29,796.
LAING, B.—"Distillation, &c., of carbonaceous materials." No. 30,032.
LAYCOCK, S.—"Gas-fired furnaces." No. 30,222.
LINTON, C. F.—"Stove for converting coal to coke." No. 29,976.
M'HARRY, W.—"Gas-producers." No. 29,728.
MENZIES, W. A.—"Street, &c., high-pressure gas-lamps." No. 29,854.
METCALFE, W.—See Haynes, H. No. 29,651.
NIELSEN, H.—See Laing, B. No. 30,032.
OTTO, E. R.—See Linton, C. F. No. 29,976.
SHAW, H. S. HELE-.—"Pipe-joints." No. 29,646.
SOC L'AIR LIQUIDE, SOC. ANON. POUR L'ETUDE ET L'EXPLOITATION DES PROCÉDÉS G. CLAUDE.—"Apparatus for synthesis of ammonia." No, 30,005.
STAPLES, C. W.—"Prepayment meters." No. 29,849.
SUTTON, C. J.—"Boxes for gas-mantles." No. 29,691.
TULLY, C. B.—"Manufacture of gas for heating and lighting." No. 30,180.
VICTORY PIPE JOINT COMPANY, LTD.—See Shaw, H. S. Hele-. No. 29,646.
VICTORY PIPE JOINT COMPANY, LTD.—See Kerr, A. C. No. 29,796.
VOGEL, J. L. F.—"Production of gaseous fuel." No. 29,787.
WELLS, J. F.—"Grates for gas-producers, &c." No. 30,226.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" of applications by gas undertakings to the Board of Trade under section 1 of the Gas Regulation Act.

Alnwick Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 4s. 3d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 15·8d. per therm.

Brixham Gas Company.

The statutory standard price now authorized in respect of the supply of gas by the undertakers is 4s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 18·87d. per therm.

East Grinstead Gas and Water Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 6s. per 1000 c.ft. for gas supplied within a radius of one mile from the works, and 7s. beyond this radius; and the prices they have asked the Board of Trade to substitute for these are 20·8d. and 23·2d. per therm respectively.

Shotley Bridge and Consett District Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 7·69d. per therm.

Truro Gas Company.

The standard price now authorized in respect of the supply of gas by the undertakers within a distance of 1¼ miles from the Town Hall of the borough of Truro is 4s. 2d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9·4d. per therm. The undertakers are empowered to charge for gas supplied beyond the said distance a price exceeding by not more than 1s. per 1000 c.ft. the price for the time being charged within the said distance; and the charge which they have asked the Board of Trade to substitute for this differential charge is 2·6d. per therm.

Windsor Royal Gas Light Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. 6d. per 1000 c.ft. within the limits of the borough of New Windsor, and 7s. beyond; and the prices which they have asked the Board of Trade to substitute for these are respectively 20·37d. and 24·33d. per therm.

SPECIAL ORDER.

Truro Gas Company.

Notice is given by the Company of their intention to apply for a Special Order under section 10, to enable them to issue redeemable preference shares or debenture stock, to regulate the supply of gas, to establish profit-sharing schemes, and for administrative purposes.

DECLARATIONS OF CALORIFIC POWER.

Bridgwater Gas Light Company.—450 B.Th.U. (Dec. 25.)
Harrogate Gas Company.—460 B.Th.U. (Jan. 1.)
Hessle Gas Light and Coke Company.—425 B.Th.U. (Dec. 26.)
Richmond Gas Company.—460 B.Th.U. (Dec. 29.)
Stroud Gas Light and Coke Company.—470 B.Th.U. (Nov. 21.)

GAS REGULATION ACT ORDERS.

There have been forwarded by the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Burnham Gas Company, Ltd.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 17d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-two-fifths.

Prepayment meter clauses are included. (Nov. 14.)

North Middlesex Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-two-fifths. (Nov. 10.)

Stroud Gas Light and Coke Company.

As from the declared date, the maximum price in respect of gas supplied by the undertakers shall be 19d. per therm.

The minimum permissible pressure at which gas shall be supplied by the undertakers shall be such as in any main, or in any pipe laid between the main and the meter having an internal diameter of 2 in. and upwards, to balance a column of water not less than 2 in. in height: Provided that—(1) The foregoing provision shall not apply to the urban district of Nailsworth and the parishes of Minchinhampton and Thrupp, and to Bisley Road in the urban district of Stroud, until the expiration of two years from the date of this Order; and during the said period of two years the pressure at which all gas supplied by the undertakers to any consumer of gas within the areas defined above shall be supplied shall be that prescribed by paragraph (1) of section 41 (pressure and quality of gas) of the Stroud Gas Act, 1901. (2) If the declared calorific value is less than 350 B.Th.U., the minimum permissible pressure at which gas may be supplied shall be that specified in the schedule to this Order. (Nov. 14.)

THE RATING OF GAS UNDERTAKINGS AND COLLIERIES.

Discussing the subject of "Rating and the War," at a meeting of the Auctioneers' and Estate Agents' Institute, held in London, Mr. P. Michael Faraday said it was well known to them that gas-works and similar properties were assessed upon the principle of deducting expenses from receipts, and dividing the net revenue between the tenant on the one hand and the landlord on the other. It was, however, a canon of rating that the tenant's demands should be satisfied first; that was to say, a reasonable trading profit and a reasonable rate of interest should be allowed the tenant for his capital in connection with running the concern—the residue being available for the landlord. With railway companies, gas companies, electric light companies, and others, the cost of coal and the additional cost of labour were factors which had arisen altogether out of proportion to the increased price obtainable for the service. Hence there were deficits; and the companies, in order to make ends meet, were seeking to reduce their local ratings—and rightly as the law now stood. Local authorities needed the money to carry on the services they were compelled to provide in the interest of the community; and it seemed to him that the solution was to be found in a policy under which the spending authorities must expend as little as possible commensurate with providing essential services, in order that the ratepayers might not have to find more than they could possibly afford. Otherwise the breaking-point was reached. His experience showed him that a large number of companies could not possibly pay the rates they did in 1914, as their profits would not permit of such a contribution. The upheaval in the colliery industry had caused the greatest difficulties in assessment. Before the war, collieries were by no means easy to assess equitably. The general practice, with which they were all familiar, was to rate a colliery on the tonnage of coal produced—the returns of the previous year forming the basis of valuation for the period of the rate; the tonnage rate being in theory the royalty paid to the landlord for the right to take the coal, *plus* something as interest on the outlay to erect the necessary plant and buildings for working it. Equality of assessment as between two pits was difficult enough; and what generally happened in fact was that a basis was agreed as between the colliery owners and the assessment committees. This frequently remained unchanged for a considerable period. The situation brought about by the war was, however, not so easily solved. The war had had the effect of completely disorganizing the industry. During hostilities, owing to the demand for coal, pits which had been shut-down and were previously derelict, on account of the impossibility of working them to produce coal economically, were re-opened; the necessity for coal being of greater importance to the country at that time than the question of how much per ton it cost to win it. Coal control, however, temporarily met this difficulty by taking from the best pits a proportion of their profits in order to defray the losses in the uneconomic ones. During the war also, the cost of producing coal rose to such an extent that it could no longer be said that we possessed cheap fuel for the benefit of our other industries. But, of even greater importance, this increase in production cost had brought foreign coal into markets that before the war were exclusively held by our export trade. So much was this the case that the trade is to-day, in comparison with what it was, practically non-existent. They had, therefore, confronting them as rating surveyors, an industry for the proper rating of which to-day the past gave them no guidance. It was the same

industry only in so far as it produced the same commodity; but the conditions under which it produced that commodity and the conditions of the markets in which in the past it was wont to dispose of it were so altered that they could not be regarded in any sense as comparable. What then were they to do when it became their duty to value for assessment purposes the various units that formed this industry? It was clear that until, by effluxion of time and concerted national effort, we had obtained a readjustment to something approaching normality of our great national undertakings, the assessment of them would have to be left to the good sense and the good faith of the parties. To apply strictly the rules which were good and which prevailed in pre-war days would result in such absurdities that he was satisfied that neither assessment committees nor ratepayers would desire it. It seemed to him, therefore, that these matters must be dealt with by a give-and-take principle; but *prima facie* there was a case for a reduction in most industrial undertakings where the poundage of rates had risen. As an indication of the assistance they might expect to receive, he was looking-up the report of the Royal Commission on Local Taxation, which, he believed, sat for some years prior to 1910 to investigate large numbers of cases of special properties. After sitting several years, for the purpose apparently of formulating a scheme to reduce chaos to order, the Commission resolved that: "We do not think that it is desirable or indeed possible for us to make any recommendations with regard to the actual procedure which should be adopted in ascertaining the annual value of these properties. There must always be some difference of opinion among valuers on the question of what a hypothetical tenant might reasonably be expected to pay; but we think that it is of great importance that the valuation of these special properties should be centralized as far as possible, and undertaken by the most skilled class of valuers."

BRITISH SULPHATE OF AMMONIA FEDERATION, LTD.

First Annual Report.

The past year was the twenty-fourth year of propaganda work undertaken by British sulphate of ammonia makers—acting successively through the Sulphate of Ammonia Committee, the Association, and the Federation.

The makers who founded the Federation foresaw that the enormous expansion in the capacity for producing nitrogen in the world during the war would probably result in an excess of production over consumption, and thus cause keen competition among producers. But it was felt that this competition was almost certain to come primarily from producers by synthetic processes. The event has proved the assumption correct. But while the primary cause of this competition is Germany's independence of foreign supplies because her synthetic and other plants satisfy her total home needs, the proximate reason for the present glut of nitrogen in the world is the failure on the part of nitrate of soda producers to limit their output to a quantity which could be consumed within reasonable time. Chance made a strengthening of the Chilean Nitrate Producers' Association coincident with the penultimate phases of the trade boom. The Association fixed a series of high prices for future delivery; and merchants, bankers, and speculators bought-up the entire production, without any clear idea as to how these vast quantities of nitrate were to be consumed. Part of it was to restore agricultural prosperity to remote and struggling peoples such as the Poles, the Ruthenes, and the Czecho-Slovaks; and part to help American farmers to supply the wants of the rest of an underfed world. On such foundations were built the hopes of the speculators. The only solid thing in the whole vast transaction was the high price paid to the producers. The shares of nitrate-producing companies rose to unprecedented heights. Unfortunately for the "holders," when the time came for shipment, those among the new consumers whose financial resources were not fully employed in making war on their neighbours, could not offer in return for the nitrate anything more realizable than options on future crops. A little later American farmers began cutting-down their fertilizer requirements to an alarming extent, because the world was clearly unable to pay the high cost of the crops they still had in stock.

The result was that nitrogen for several months became practically unsaleable except in small quantities; and well over a year's normal supply had accumulated in stores all over the world by the end of the consuming season. The nitrate producers were faced with the unpleasant alternatives either of making large rebates to the "holders," so that prices for the new season might be reduced, or of engaging in a price-war which would eliminate many of the "holders," and thus render a fresh selling organization necessary.

We have alluded summarily to the difficulties of nitrate producers because we think they illustrate the dangers which beset makers who are not in the closest possible touch with consumers, and who do not exercise more discrimination in their choice of customers than is satisfied by purely financial guarantees.

The policy of the Federation has been, and is, to sell to those merchants who both at home and abroad sell direct to consumers. In this way we receive first-hand information as to conditions affecting demand; we can stimulate demand in backward countries by making special arrangements in regard to price and selling conditions; and we can to some extent foresee and provide for the results of excess or failure of demand at any particular point.

It is obvious that it would not pay individual producers to act in this way. We feel, therefore, that this function is one justification for the Federation's existence.

Stability of the Federation

The financial crisis which gradually paralyzed business all over the world during the early months of 1921 severely tested the stability of organizations old and new, and many failed to survive the ordeal. The two essential guarantees which the Federation has undertaken are first to take delivery from its members so as to enable them to produce continuously, and secondly to pay members a reasonable interim price for their whole production month by month. We were able to carry-out our obligations to our members in both respects throughout the year, although this involved financing and storing quantities equal to three months' production at times. It would appear, therefore, that the constitution of the Federation provides the Council and Executive Committee with the requisite machinery to tide-over critical periods presenting exceptional difficulty.

Our Home and Export Markets.

In spite of the abundance of nitrate available, the consumption of this fertilizer in the United Kingdom last year was only about two-thirds of the pre-war figure; whereas we delivered more than four times the quantity of sulphate used on the land before the war, in spite of the fact that the price was regarded by farmers as a high one. Of our production 57 p.ct. was absorbed by the home market, as against about 11 p.ct. before the war. At the same time we have regained a footing in nearly every importing country overseas, except those and their near neighbours in which the production of sulphate is sufficient, or more than enough, for their needs. We have lost the American, the German, the Hawaiian, and that portion of the Japanese market which is supplied by home production—about 90,000 tons. These losses (about 78,000 tons) were much more than counterbalanced by the 167,000 tons consumed at home, 125,000 tons of which represents a new market.

Although much has been done in this respect, we are persuaded that there are yet new fields to conquer in this same home market. An exceptionally interesting series of experiments now partly completed at Rothamsted, seems to show that far heavier dressings of sulphate may be applied with profit than were admitted under the theory of the law of diminishing returns. During the year, too, remarkably successful results have been obtained in England with sulphate as a killer of charlock and other broad-leaved weeds, by applications at the rate of 2 cwt. per acre in water.

Recent experiments on a large scale in Germany also tend to show that far heavier doses of nitrogen may be applied to crops with profit.

As to our export markets, we have begun to recover our pre-war position in Java; and by careful selection of the best quality available, we have avoided those complaints and disputes which were in the past the invariable concomitants of falling prices.

A table is appended showing the quantities exported to overseas countries since 1913, and giving a summary of the figures for production and consumption. Of the 166,920 tons delivered for home use, Scotland consumed about 50,900 tons, Ireland 26,000 tons, England and Wales, including the Channel Islands and the Isle of Man, 90,000 tons, as against 71,900, 42,200, and 119,600 tons respectively during the previous season.

More competition was experienced from nitrate of lime and nitrolim (cyanamide) than in the previous season. None of the new German synthetic compounds have yet been offered here.

Political Events.

The predominant tendency of the post-war world is unfortunately to allow political prejudice to confound economic sanity. Instead of endeavouring to repair the vast material destruction of the war by promoting free interchange of commodities, every nation new and old is hedging itself about with tariff walls. Thus Italy and Spain are imposing duties of 6s. 8d. and 9s. per ton (at par of exchange) on sulphate of ammonia in order to encourage home production. Congress in the United States is being asked to impose a duty of no less than $13·44, or about 70s. per ton at present exchange.

The outstanding and most disastrous among events which must be reckoned as political was the coal strike. There were no reasons, except political reasons, why the settlement finally arrived at should not have been reached before a single man left the pits. The strike and its consequences will involve a loss of production of sulphate of ammonia amounting to about 140,000 tons.

International Conferences.

Although British production of nitrogen can only claim fourth place in the list of the producing countries of the world, yet owing chiefly to our geographical position, but also, we think, to the considerable impression created in the minds of the foreign groups by the knowledge that the Federation represents nearly the whole British production, we have been able to take a leading part in conferences which have undoubtedly so far prevented a war of extermination among the producers of the different forms of nitrogen. In all the circumstances, it was only natural that our first meeting with the German Nitrogen Syndicate in Berlin in February, 1921, should have produced negative results.

The second conference held at Rotterdam four months later, at which all the four largest producers of nitrogen were represented—the nitrate of soda producers, the German Syndicate and ourselves in person, and the Americans by proxy, because we had previously ascertained their views and found them identical with ours—commenced on a much more hopeful note and led to a working agreement, which has been observed by all parties. It is too early as yet to say whether it will be possible to arrive at a permanent solution of the admittedly very great difficulties which stand in the way of rational regulation of production and distribution of the multifarious forms of nitrogen, all of which in their present abundance the world appears to be unable to consume.

Nevertheless, a beginning has been made, goodwill has been manifested on all sides, and the conferences have at least led to a much better understanding of the position in which each group stands. The "primary" producers now appreciate to the full the strong position which "secondary" or "bye-product" producers occupy.

Consumers and Prices.

We have naturally given first place in this report to our efforts to defend the interests of our members. But lest the remarks made above should lead consumers to conjure up visions of a world-wide nitrogen trust intent on obtaining a stranglehold on the food of the people, we desire to point to the other side of the picture. In the first place, improved methods of synthetic production have made it possible to produce practically unlimited quantities of nitrogen. This being the case,

any attempt to maintain prices at a level which gave existing producers inordinate profits would inevitably and immediately call into being fresh production. Secondly, at the present time, the supply of nitrogen exceeds the demand, and prices have had to be reduced heavily to secure increased consumption. The average price for sulphate of ammonia to home farmers during the year under review was about £23 5s. per ton delivered to consumers' nearest station, in four ton lots, basis 24½ p.ct. ammonia. Even at this comparatively high figure the unit value of nitrogen was considerably cheaper than in any other exclusively nitrogenous fertilizer. Moreover, the percentage advance in the price of sulphate was much less than the percentage increase in the selling value of the farmers' crops, comparing both with pre-war figures. It became obvious towards the end of the season, however, that the prices for nearly everything the farmer produces were going to be on a much lower level. In view of the large stocks of nitrate of soda and sulphate of ammonia which remained unsold at the end of the season, and in order to avoid the paralyzing influence of constantly falling prices on consumption, the Committees decided to cut prices to the lowest possible level with a view to re-establishing a steady but gradually rising scale of prices for next season. In June and July, 1921, prices were therefore reduced in two steps to £13 3s. per ton—a pre-war price. The results of this action will be dealt with in the next report.

Cost of Production.

While selling prices showed a falling tendency during the year, costs of production were probably the highest on record at the beginning of the season. In the later months, there was some improvement, chiefly due to the fall in the price of fuel. Unfortunately, no substantial reduction was made in the price of sulphuric acid, despite the urgent appeals to the acid makers. They have sought to justify the high prices charged on the ground that falling-off of consumption and consequent reduced output have enormously increased overhead charges. But it is becoming evident that the chemical industry of this country cannot afford to pay prices ranging from £5 to £7 per ton for its chief raw material if it is to compete with other nations, and that the only way to secure increased consumption is to reduce prices. At the time of writing, acid makers are showing a disposition to meet the situation by further reductions. We need hardly assure members that we shall continue to use the utmost endeavours to enable them to obtain acid at a fair price.

Quality.

There has been some improvement in the quantity of neutral sulphate of ammonia produced, and various new patents have been registered. Among processes specially designed for use in small works, the "Bedford" method has been favourably commented on by experts. It is to be hoped that we shall be able to report further progress under this heading next year.

Propaganda Work.

The certainty that we shall have to meet competition from other forms of nitrogen to an increasing extent has caused the Committees to devote special attention to the question of making the propaganda as effective as possible. The Committees are satisfied that the most effective method of propaganda is personal contact with farmers; and this work can be best accomplished by having a number of agricultural advisers situated in districts throughout the country. It is, therefore, proposed gradually to increase the number of the outdoor staff.

During the year, a number of experiments and demonstrations have as usual been arranged. Apart from these activities, special experiments have been carried out at our request at five of the Agricultural Colleges in England and Wales. The results of all these demonstrations and experiments have been published to farmers throughout the United Kingdom. As far as the experiments are concerned, these have again been arranged on as large a scale as possible. We find that tests carried out on several acres bring more conviction to practical farmers than results obtained on small plots.

We have concluded an arrangement with the National Institute of Agricultural Botany by which they are placing their farms at St. Ives (Hunts) and Ormskirk at our disposal for manurial experiments; and the co-operation of producers of phosphatic and potassic fertilizers has been secured. It is intended to carry out the manurial programme on these farms in an entirely practical manner, just as if they were being farmed by ordinary farmers. Arrangements have been made to invite the county agricultural advisers, who work under the Agricultural Education Association, and farmers from all over the country to come and see the results obtained. If, as we hope and expect, this experiment is a success, we hope to arrange similar demonstrations on a large practical scale on farms throughout the country.

We have continued to devote attention to agricultural shows; and during the year a large and attractive new show stand has been purchased. We exhibited at the Royal Show at Derby, and also at the principal county shows.

Messrs. Sutton & Sons again kindly supplied us with a most instructive set of exhibits, demonstrating the benefit to plant life from applications of sulphate of ammonia.

As regards foreign propaganda, we have continued our work in Egypt, Spain, and the Canary Islands, on the lines hitherto adopted.

Membership.

We are pleased to be able to report that, at the time of writing, many of the important makers who were parties to the equalization scheme have joined the Federation. We appeal to our members in the various districts to use their influence to endeavour to get those makers to join the Federation who have not yet done so.

Head Office Staff.

It is a great pleasure to the Committee to inform members of their satisfaction with the work of the staff during the very trying year under review. Mr. F. C. O. Speyer, the General Manager, Mr. E. Castellain, the Assistant Manager, Mr. H. Jones, the Secretary, and the staff generally have never spared themselves to make the Federation a success. In Mr. Speyer we have, fortunately, a Manager of great ability, courage, and resource; and we feel that the Federation owes him its special thanks for his work

CROYDON GAS COMPANY.

Price Reduction and a Special Order.

The Directors of the Croydon Gas Company have decided to make from Jan. 1 next a reduction in the price of gas of four-fifths of a penny per therm, which is equal to nearly 4d. per 1000 c.ft. This represents a gain to the consumers at the rate of over £30,000 a year.

At a special meeting of the Company on Friday, the 11th inst., a resolution was unanimously agreed to by 128 proprietors (including 52 employees of the Company holding between them £6000 of stock) favouring an application being made to the Board of Trade by the Company for a Special Order under section 10 of the Gas Regulation Act. There are thirty-six sections in the Draft Order, dealing principally with the making of adequate provision for the steady increase of the undertaking, which, even under the handicap of war conditions, has not ceased, and which post-war building conditions are already beginning to accentuate. Conversion and consolidation of stocks, which will ultimately have the effect of enhancing their value, have prominence.

The Chairman (Mr. Charles Hussey, J.P.) explained that they lost no time in submitting their proposals under section 1 of the Act, which were pressed forward energetically in the spring, with the result that out of the whole country theirs was one of the first three Orders made by the Board. As a consequence they were enabled for the June half year to declare dividends at the pre-war rates, while many other companies were still working under the financial handicaps which the cumulative effects of war conditions had imposed. Had the Directors tried to combine with their first application one on the lines they now submitted—the necessity for which they then knew—it was practically certain that, with the pressure of work the Act had entailed for the Board of Trade, their case would have been held-over, and the shareholders would still be suffering the reduced dividends.

With regard now to the necessity for so early an application for a second Order, they were still faced with the need for large capital expenditure—partly to carry out or complete extensive works which but for the war would have been done long ago, and partly to make provision for the increase of their vast undertaking. A new holder had recently been started, which would sensibly relieve, though not remove, the strain under which manufacturing work had had to be carried on during the past few winters. They were nearing the end of their powers to raise further capital, and it was in the interests of all concerned that they should be able to procure their money requirements in the most favourable way that market conditions would allow. The Company were asking for power to raise enough to carry them on for eight or ten years.

It was also proposed that their five classes of stock should be simplified by converting them into two stocks—one subject to the sliding-scale, the other carrying a maximum dividend of 5 p.ct. in such manner that the amounts to which proprietors should be entitled as dividends would be precisely the same as now, though expressed as a lower rate on a larger nominal amount of stock. This would be of advantage in several ways. The rate of dividend declared would more closely represent the yield received by their stockholders on the actual amounts invested by them. The complexities of their present stocks would be to a large extent removed. The total amount of any one kind of stock outstanding would be larger, and would be of a kind more favoured by investors than their present high dividend bearing stocks; and this the Directors were satisfied would ultimately have the effect of increasing their marketability, and as a consequence enhancing their value. He did not propose to go in detail into the manner in which this conversion was to be carried out; but the general effect would be that instead of declaring dividends at the rates of 15, 12, 10, and 5 p.ct., they might expect there would be dividends at the rate of 6 p.ct. on ordinary and 5 p.ct. on the maximum dividend stocks, while the sums actually received by individual proprietors would remain unchanged.

On the shareholders giving their unanimous vote for the resolution, the Chairman and the Deputy-Chairman (Mr. T. Rigby) expressed the opinion that they had done very wisely.

At the close of the meeting the proprietors viewed the memorial tablets erected by the Directors in the entrance hall of the offices, commemorating those employees of the Company who gave their lives, as well as of those who served, in the war—288 in all.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

Therm System Adopted.

In a notice issued to consumers on the 3rd inst., the Alliance and Dublin Consumers' Gas Company, in accordance with their Order under the Gas Regulation Act, gave notice that the calorific value of the gas which they intended to supply was 450 B.Th.U. gross, and that the date from which they would supply gas of this calorific value was Nov. 7. An explanatory statement was issued by Mr. W. J. Grey (the Secretary of the Company), who also announced a substantial reduction in the price of gas. This was not due to press and other agitation that has been going on in Dublin, in respect of prices and administration, or to the action of any outside body, but was foreshadowed at the half-yearly meeting some weeks ago.

Mr. Grey, interviewed by a representative of the "Journal," explained that the reduction by 2d. per therm was decided upon shortly after the receipt of the Order of the Board of Trade in the first week of October; but an official announcement could not be made pending confirmation by the Gas Company's Board. "This reduction," he said, "leaves the price at 1s. 6d. per therm, which is equivalent to 6s. 9d. per 1000 c.ft.—an increase of 93 p.ct. over the pre-war price of 3s. 6d. This appears to compare favourably with the percentage of increase in all the principal undertakings throughout the United Kingdom. Out of 26 of these undertakings, with an average number of 97,000 consumers, against Dublin's 57,000, one increase actually

amounts to 262 p.ct., the lowest is 98 p.ct., and the average 141 p.ct. It is fair to say that the dividends paid to the Alliance and Dublin Gas Consumers' Company's stockholders during the past 2½ years were at the rate of only £3 6s. 3d. p.ct., and for the previous year at the rate of £2 17s. 6d. p.ct.; but better results are not unnaturally hoped for now that the sliding-scale again comes into operation. In Dublin an increase of 1d. per 1000 c.ft. (or, as it is now, 0·2d. per therm) involves a reduction of 2s. 6d. p.ct. in the dividend payable. The basis of the sliding-scale is a standard price, based on actual costs, and a standard dividend, both fixed by Parliament or by the Board of Trade. The following figures will illustrate the *modus operandi*:

Standard dividend	£5 p.ct.
New standard price (fixed by Board of Trade) .	1s. 7d. per therm
Price of gas prior to present reduction, 7s. 6d. per 1000 c.ft.	1s. 8d. ,,
Therefore the dividend payable for the current half year will be at the rate of	£4 7s. 6d. p.ct.

"On the contrary, if the new price of 1s. 6d. per therm is maintained during the coming half year, the dividend payable, profits permitting, would be increased to £5 12s. 6d. p.ct. The stockholders are, no doubt, no less interested than the consumers in this illustration. The interests of the two classes are identical, though for every £1000 the stockholders receive in extra dividends the consumers must first get reductions amounting to £3000. In substitution for an illuminating standard the Company must now supply, under penalty, gas of not less than the declared calorific value—in the case of Dublin this is 450 B.Th.U.—but any excess over this standard the consumer gets free.

"There will probably be some mistrust of the new terms until consumers get used to them; but it should be remembered that we no longer purchase a certain quantity of gas and pay for it by volume, independent of its heating value (the only value of gas which counts nowadays), but that we are actually purchasing potential heat, and the rate per therm is really a rate for a definite quantity of potential heat. The following illustration will help to fix the idea:

1s. 6d. per therm for a 500 B.Th.U. gas is equivalent to 7s. 6d. per 1000 c.ft.
1s. 6d. per therm for a 450 B.Th.U. gas is equivalent to 6s. 9d. per 1000 c.ft.

"Much has been said on the subject of defective meters; but the Company are doing all in their power to remedy matters; and, in the meanwhile, the consumer can always appeal to the official tester if he suspects his meter is working against him. We were, however, we must admit, surprised to learn that of the total number of consumers' meters suspected of inaccuracy and tested by the official tester of the Dublin Corporation during the year ended March 31 last, only 3 p.ct. proved to be operating against the consumer, 2½ p.ct. were correct, while 94½ p.ct. were working against the Company. Where meters have been proved to be working fast, an appropriate allowance is always made to the consumer; when they are slow, or have ceased to register, an estimation of consumption is inevitable. If the consumer can show that the rate of consumption for the period of estimation should be less than the rate of consumption for the periods on which the estimate is based, he can secure a reasonable abatement. Of course, the converse can happen. The rate of consumption for the estimated period must sometimes be at a higher rate; but it is believed that there is no case on record where a consumer has volunteered information to this effect.

"We have endeavoured to elicit some information with regard to the additional charge for prepayment meters and fittings; and the Company maintain that this additional charge is the same as that charged by numerous gas undertakings in Great Britain. They are unable to institute an actual comparison without being in possession of details of fittings supplied with slot installations by such companies; but the fittings supplied, free of rent, in Dublin, consist of the service from the main to the meter, meter, cooker with piping, &c. Such an installation cost, before the war, over £6 10s.; and the average consumption per slot consumer was then 8300 c.ft. The gross return, therefore, amounted to only 8s. 4d., or £6 8s. 2d. per cent., out of which must be defrayed, not only interest on capital, but the cost of collection, repairs and renewals, and depreciation.

"Considerable stress has been laid on the disparity between the Dublin and Belfast prices. Why was gas 7s. 6d. in Dublin, and 4s. 7d., less 20 p.ct., in Belfast? Why, ask the Company, was the Belfast price one of the very lowest in these counties before the war, and why is it now very considerably less, with one exception, than the price charged by the big British undertakings, including the great London Companies? Why is the price of gas 2s. 5d. in Widnes—the exception referred to—while in Manchester's enormously greater area of supply the price is 4s. 2d., and in Newcastle-on-Tyne, built (one might say) on a coalfield, the price is 5s. 6½d.? The answer to all these questions is to be found in the words 'dissimilarity of conditions.' These could be fully revealed only through an intimate knowledge of the detailed accounts of the various undertakings; but the following points of dissimilarity between Belfast and Dublin are obvious, and obviously also not in Dublin's favour. The figures are taken as at the end of 1919:

	Dublin.		Belfast.
Number of consumers	56,856	..	84,958
Consumers per mile of main . .	88	..	174
Consumption per mile of main .	2,362,000 c.ft.	..	5,103,000 c.ft.

"There is the further point that the consumption per consumer is greater in Belfast than in Dublin.

"It must not be forgotten that, during the time when people were glad to have gas at any price, the Company, in order to maintain an uninterrupted supply, were compelled to agree to advances in the war bonus and reductions in working hours. War bonus alone during the past half year cost 1s. 6d. per 1000 c.ft.; and the elimination of this item wholly or in part will consequently be hailed with satisfaction by the consumers."

In order to find work for the unemployed in the district, the Bridgnorth Town Council have decided upon a scheme of extension of the gas-mains.

IMPERIAL CONTINENTAL GAS ASSOCIATION'S CLAIM.

A statement in the City Notes of "The Times" on Monday was to the following effect: The Imperial Continental Gas Association have received information that the Association's claim against the German Government has been settled for £1,600,000. Last week the ordinary stock of the Association rose rather sharply, presumably in anticipation of the settlement and the prospect of what in America is described as a melon-cutting operation. But we understand on good authority that the £1,600,000 is not likely to be used in making any further return on capital. Both the ordinary and debenture stocks will remain as at present; but when the money is received, a distribution of about £50 per £100 is likely to be made to holders of the £1,976,000 of capital stock. This distribution, being in respect of capital, would not be subject to income-tax. Of the balance of £600,000, some portion of it would be set aside to meet income-tax and corporation duty, a large sum would be appropriated to strengthening the pension fund, and the rest would be placed to a reserve against exchange fluctuations—the Association's chief business now being in France and Belgium. It will be remembered that the Association received from the Enemy Debts Clearing Office on Nov. 30, 1920, a payment on account of £4,740,527 in respect of the liquidation of their property, rights, and interests in Germany. This was appropriated, first, in payment of a dividend of 20 p.ct., tax free, on the capital stock, being in respect of profits; secondly, in reduction of the capital stock from £4,940,000 to £1,976,000 by the return of 60 p.ct.; and, thirdly, in repayment of 65 p.ct. of the 3½ p.ct. debenture stock at the price of 105.

SEWER GAS AS A MOTIVE POWER.

Experiments in Birmingham.

A paper dealing with the possibilities of the utilization of sewer gas as a motive power was read by Mr. JOHN D. WATSON (the Engineer of the Birmingham Tame and Rea District Drainage Board), at a meeting of the Institution of Municipal and County Engineers in Birmingham on Saturday. The scientific experiments, and the practical developments in the utilization of marsh gas, which is formed by organisms acting upon decaying vegetable and other organic substances, have taken place on the Birmingham Sewage Works, where 400,000 tons of wet sludge (equal to 36,000 tons of dry solid matter) are dealt with annually.

Mr. Watson pointed out that gas was evolved by an intensive fermentation process; and recently a sewage-gas plant had been substituted for a suction-gas plant. The principal constituents of sewage gas were methane (or marsh gas), nitrogen, hydrogen, and carbon dioxide. Reliance was placed chiefly on the first named, the percentage of it being 77. Analytical results obtained by Mr. T. F. E. Rhead (Chief Chemist to the Birmingham Gas Department) showed the need for more definite information and caution in the application of marsh gas. Steps were being taken to prepare graphs showing the volume of gas to be obtained from a given volume of average sludge (10 p.ct. of dry solid matter); at what time the sludge gave off the maximum quantity of gas; and what period was needed to change this maximum into a minimum. It was from sludge, and not from liquid sewage, that gas could be obtained in sufficient volume to render its use economical. It was estimated that about 2 tons of wet sludge (10 p.ct. of dry solid matter) a day would be required to provide an explosive gas capable of generating 25 B.H.P. for a working period of six hours per day. The sludge, after it had been discarded, was probably freer from fat and grease than before fermentation. It would still retain about 2 p.ct. of nitrogen, after it had given off its methane.

On the economic side, a sewage-gas plant compared most favourably with a suction-gas plant. The agitation of sludge was beneficial for the production of marsh gas; but one was at present ignorant of the extent to which it should be carried. Temperature, too, played an important part on the rate of evolution of the gas, and the volume extracted from a given quantity of sludge. Domestic sewage was better than any other for gas products, but freedom from acids was desirable.

TRADE NOTES.

[For "Journal" Advertisers.]

Piggott's Pressed Steel Tanks.

It is pointed out by Messrs. Thomas Piggott and Co., Ltd., of Birmingham, that prior to the securing by them of the patent in connection with pressed steel standard-plate tanks, no attempt had been made to standardize the manufacture of steel tanks so that tanks of various dimensions might be built from stock plates. The advantages of the invention being clear to the firm, they devoted considerable time and expense to the development and efficient manufacture of these patent plates, and laid down special plant. In this way, they are able to produce plates of great accuracy, from which tanks of almost every size and shape, with flanges either inside or outside, may be constructed. So successful have these efforts proved, that already there have been made and sold over 15,000 tons dead weight. In an illustrated pamphlet just to hand, attention is drawn to the fact that these patent tank plates are about one-third the weight of cast-iron tank plates of the same size, in addition to which they are unbreakable, and therefore easily handled. Their lightness and standardization render erection a very simple matter. Unskilled labour only need be employed.

Welsbach Specialities.

There have been received from the Welsbach Light Company, Ltd., of Kings Cross, W.C., copies of three new season's catalogues. They refer to glassware, burners and lamps, and gas-fittings (supplement). The lists which accompany them show that prices are in many cases considerably reduced.

CURRENT SALES OF GAS PRODUCTS.

Tar Products in the Provinces

Nov. 21.

The average values for gas-works products during last week were: Gas-works coal tar, 42s. 6d. to 46s. 6d. Pitch, East Coast, 45s. to 47s. 6d; West Coast—Manchester, 40s. to 45s.; Liverpool, 40s. to 45s.; Clyde, 40s. to 45s. Benzole 90 p.ct. North, 2s. 4d. to 2s. 6d.; crude 65 p.ct. at 120° C., 1s. 11d. to 2s. naked at makers' works; 50-90 p.ct., naked, North, 2s. 3d. to 2s. 4d. Toluole, naked, North, 3s. to 3s. 1½d. nominal. Coal tar crude naphtha in bulk, North, 11d. to 11½d. Solvent naphtha, naked, North, 2s. 8d. to 2s. 9d. Heavy naphtha, North, 2s. 7d. to 2s. 9d. Creosote, in bulk, North, liquid, 6½d. to 7d.; salty, 6½d. to 6⅝d. Heavy oils, in bulk, North, 10½d. to 11½d. Carbolic acid, 60 p.ct., 1s. 6d. Naphthalene, £15 to £20; salts, £7 to £9, bags included. Anthracene, "A" quality, 8d. to 10d. per minimum 40 p.ct.; "B" quality, nominal.

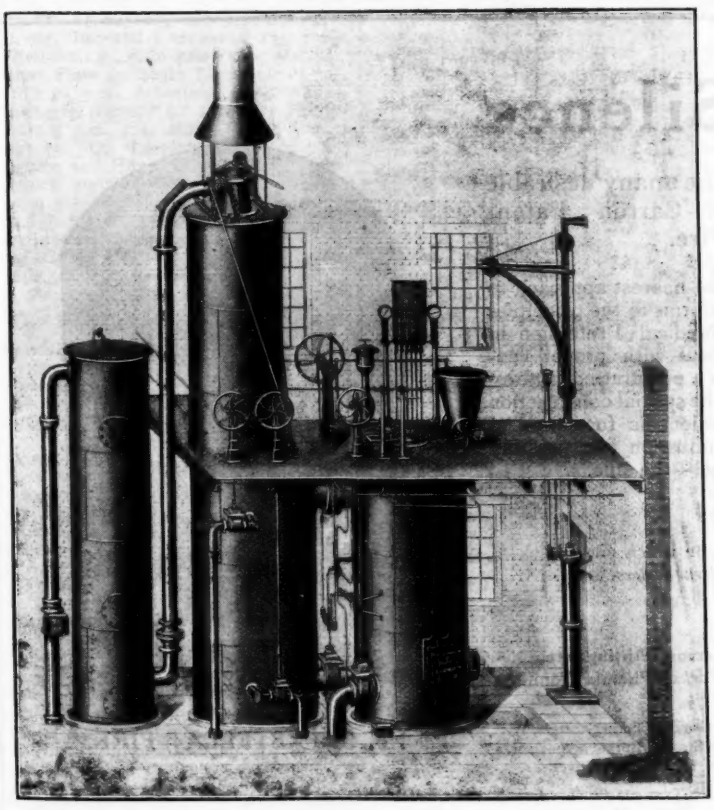
FROM A MARKET CORRESPONDENT.

There is nothing fresh to report in connection with the tar products market. The demand generally is poor, although in some departments a fair amount of business is being done. Pitch remains weak and depressed, and an idea is prevalent that still lower prices will be seen. Present prices are purely nominal at 45s. to 50s. per ton, according to district. Creosote is rather firmer than when last reported, although there is no noticeable change in quotations. Carbolic acid remains as dull as ever; crystals being 5d. per lb. and crude 60's 1s. 6d. per gallon. Cresylic acid remains in the neighbourhood of 2s. 4d. per gallon. There are rather better supplies of solvent naphtha, and the price is somewhat lower at 2s. 8d. per gallon. Crude naphthalene remains at £5 to £8 per ton, and refined at £15 to £18 per ton. The demand for benzole remains very good at 2s. 10d. per gallon for 90 p.ct. Pure benzole is scarce, with business at 3s. 8d. per gallon. Trade in intermediate products continues quiet. Although buyers are only covering their immediate requirements, there is a very fair export inquiry; and this section is likely to become more interesting, as Continental supplies are rather short. Aniline oil and salt are firm at 1s. 7d. and 1s. 8d. per lb. respectively. Salicylic acid remains at 1s. 4d. per lb. Beta naphthol is much more interesting than of late, although prices remain at 2s. 6d. per lb.

Sulphate of Ammonia.

The requirements of the home trade are still small. Supplies are fairly plentiful in most districts, although the margin to cover any unexpected demand is not very great. On the other hand, there have been good inquiries on export account, and shipments during the past month have represented a fair total value; the official figures show that 11,558 tons, valued at £157,074, were exported in October, comparing with 12,262 tons in September. The Dutch East Indies was still the largest consumer, although the quantity taken is only very little more than half that exported during September. The total exported to that country up to the end of October was 20,358 tons. Spain and the Canaries have taken more than 1400 tons, with a value of over £20,000, in October. That this market is an important one is shown by the fact that during the first ten months of this year 34,800 tons were dispatched there. Italy has come forward as a buyer in our market, with a purchase of 25 tons in October, against nothing whatever in September. France has again increased her purchases, taking 3477 tons, against 2796 tons in September; bringing the total of exports to that country for the ten months of this year up to 25,600 tons, which is about one quarter of the total quantity exported during that period. Japan took less than 500 tons in October, at an average price of £13 per ton, compared with 750 tons in September. From information received from America, however, it would seem that Japan is doing fairly extensive business in that country—a shipment of some 21,000 bags from one of the large coke-oven plants at Birmingham (the Tennessee Coal, Iron, and Railway Company) being reported by the last mail. Prices in America are rising; but even so the United States is at present the cheapest producer of this material. The French producers have not yet announced their intentions for the coming season. The market in France is very quiet, although French production has been entirely absorbed, and all demands are being met with imported material. It is quite probable that supplies of this fertilizer in France will be scarce during the coming season, and French consumers will probably draw upon the British market for their requirements.

Price of Glasgow Gas.—An endeavour, it is understood, will shortly be made to persuade the Gas Committee of the Glasgow Corporation to reduce the price of gas. Last April, owing chiefly to the cost of coal supplied from abroad, an increase of 7d. per 1000 c.ft. was made on the gas charges. At the close of the financial year in June, the Gas Committee reported a loss of £117,000; and the balance-sheet disclosed a deficit of £39,000 from the previous year. As considerable reductions on the wages bill and bonuses paid to the employees are to be made, and as the price of home coal in plentiful supply has returned to more like normal, a movement has been made in Committee with the view of reducing the charge for gas by at least the most recent increase—namely, 7d. per 1000 c.ft. Difficulties which may cause the Committee to delay making any concession lie in the fact that the output of gas has been greatly lessened for some time past, owing to the stoppage, or partial stoppage, of numerous works and manufacturing concerns in the city. Moreover, the sale of residual products has been disappointing.



DEMPSTER'S PLANT FOR LIGHTLY CARBURETTED WATER GAS.

DEMPSTER'S
COMBINATION OF
BLUE AND
CARBURETTED
WATER GAS
PLANTS

THE BEST FOR
EFFICIENT
AND ECONOMIC
RESULTS.

R. & J. DEMPSTER, LD.,
GAS PLANT WORKS,
MANCHESTER.

Telephones: 54 and 2296 CENTRAL.
LONDON TELEPHONE: VICTORIA 7426.

Brentford Gas Company's Reduction.—The Brentford Gas Company announce that, after the close of the Christmas term, the price of gas supplied to private consumers will be reduced. At present, the charge per therm is 1s 6d.; and the reduction to be made is 1d. per therm. This reduction, which represents a saving of about £85,000 to the consumers, is equal to 4·6d. per 1000 c.ft.

Facilities for Obtaining Gas Appliances.—By means of a full page illustrated advertisement in a local paper, the Great Yarmouth and the Gorleston and Southtown Gas Companies announce that they are now able to resume the supply of gas appliances on terms which had to be temporarily withdrawn during the war years, and to place at their customers' disposal still greater facilities for obtaining such appliances. Fires and cookers, whether purchased outright or hired, are fixed free. Burners and all appliances are maintained free of labour cost to the consumer—materials actually used only being charged for at current rates.

Sale of Porthcawl Gas-Works Suggested.—A motion was brought forward by Mr. Dan Davies at the last meeting of the Porthcawl Urban District Council that the Council's gas-works be sold to the highest bidder. He said that the works cost £40,000, and the Council were losing 6d. on every 1000 c.ft. of gas sold. They were unable to supply gas to 109 houses, because they could not afford the connections. Mr. D. J. Rees seconded, on the ground that it would be in the interests of the town to sell. Mr. C. Bragg moved that the matter be deferred for a year, inasmuch as the cost of coal and wages was now coming down. He said that last week they purchased coal for 35s. a ton, and wages were down £25 a week. Mr. Deere expressed the opinion that it was a pity the question was brought up at the present time; for the works were mortgaged up to the hilt, and when the report appeared in the newspapers it would certainly injure the prestige of the Council. The motion to defer action for twelve months was passed.

Dublin Gas Prices and Wages.—A deputation from the Dublin Corporation Lighting Committee conferred with representatives of the Alliance and Dublin Consumers' Gas Company last week, on the question of gas prices. The proceedings were private; but it is understood the Committee propose to make recommendations for reductions of the 6s. 9d. per 1000 c.ft. charge to ordinary consumers, and the rates to slot-meter users. For some time past, negotiations have been proceeding between the Company and their workers on the proposed reduction of wages by 6s. 9d. per week. The Lord Mayor (Mr. L. O'Neill), at a conference, suggested 6s.; and this the Company accepted—3s. to come into operation on Nov. 24, and the other 3s. on Jan. 12. The men then threatened to withdraw their labour; but, on the intervention of the Lord Mayor, arbitration was agreed to. The men had in the meantime rejected the proposal of their own representatives for a reduction of 3s. The arbitration had not concluded at last week end; but the men decided to continue work this week on a 3s. cut.

Gas Workers on Strike in Jersey.—In Jersey, the gas supply has been interrupted through a strike of gas workers, who came out in sympathy with the employees in the building and allied trades. The strike came to an end, after there had been no gas supply for three weeks.

Promise of Cheaper Gas in Sheffield.—Consequent upon the fall in the price of coal, the charge for gas in Sheffield is within the next few weeks to be reduced 5d. per 1000 c.ft., or 1d. per therm. The present price is 4s. per 1000 c.ft.; and the new rate will thus be about 3s. 7d.

Financial Statement at Barrow.—The financial statement of the Barrow-in-Furness Corporation trading departments, for the year ended March 31 last, shows that, while the electricity, tramways, and water departments have substantial deficits, the gas undertaking has yielded a net profit of £5127, after setting aside £8455 for renewals. The income from sales of gas was £93,926, and that from residuals £39,809; the total receipts being £139 253. Gas produced an increased income by £11,776. The cost of coal was £9800 more than the previous year.

Irish Gas Prices.—The Wicklow Gas Company having declined to reduce the price of gas from 12s. 6d. to 10s. per 1000 c.ft., the Urban District Council have cancelled the public lighting contract; and the inhabitants are signing a requisition demanding a reduction to 7s. 6d., failing which they will refuse to use gas after the 28th inst. The Dundalk Gas Company have reduced their price 3d. per 1000 c.ft. The Tipperary Town Council have appointed a Committee to inquire into the price of gas, which has increased from 4s. 6d. per 1000 c.ft. in 1912 to 9s. 6d. The Longford Urban Council protested against the price of gas—12s. 6d. per 1000 c.ft.—and subsequently the Gas Company intimated that a reduction was about to be made. The Galway Gas Company have reduced workers' wages by 2s. per week. The price of gas there is 10s. 10d. per 1000 c.ft. In Letterkenny (Donegal) the price is 25s. per 1000 c.ft.

An Improved Position in Birmingham.—The position of the Birmingham Gas Department is being improved by a rapidly increasing consumption, combined with slightly reduced prices for coal. Last week it was reported to a meeting of the Gas Committee that for the seven days ended the previous Saturday the output was only 5,000,000 c.ft. less than a year ago, which was equal to a decrease of about 2 p.ct. Though the increase in output is undoubtedly due in some measure to the colder weather, it is felt to be particularly gratifying, when it is recalled that only a few weeks ago the consumption was 20 p.ct. less than last year. There is, however, thought to be little prospect of an immediate reduction in the price of gas. The coal strike involved the department in a loss of approximately £140,000; and it was only after this was incurred that the substantial increase to 5s. 6d. per 1000 c.ft. was authorized. So far, very little of this increase has been collected; but by the end of December the department will have had the benefit of the 8d. increase for a quarter.

Absolute Silence

is only one of the many desirable features of the Carron Patent "Stella" Gas Fire.

By Appointment.

CARRON

This Fire is also the nearest approach to natural heat, and conforms to the principles laid down by the Medical Profession in combining radiant heat with proper ventilation. It radiates a penetrating healthy heat immediately it is lighted, while the special construction of the radiants together with the scientific formation of fire, ensure that no products of combustion can possibly escape, except by the proper channel—the flue.

Write for Gas Fire Booklet No. 6P *which gives — full particulars of these modern heaters. —*

No, 590 "STELLA" FIRE.

REGISTERED DESIGN.

CARRON COMPANY *Works*—**Carron, Stirlingshire.** *Branch Works*—**Phœnix Foundry, Sheffield.**

Showrooms: LONDON—15 Upper Thames St., E.C.4, and 50 Berners Street, W.1. LIVERPOOL—Redcross Street. GLASGOW—Buchanan Street. EDINBURGH—George Street. BRISTOL—Victoria St. BIRMINGHAM—Corporation Street.

Offices: MANCHESTER—14 Ridgefield. NEWCASTLE-ON-TYNE—15 Prudhoe Street. LEEDS—15 Park Row.

The Directors of the Continental Union Gas Company, Ltd., announce that a dividend of 3 p.ct., less tax, will be payable on Jan. 2 next, on the 7 p.ct. preference stock, for the year ended June 30 last.

The Cannock Gas Company have offered to provide a gas supply to the Great Wyrley district, on the usual terms, if the Parish Council will guarantee 10 p.ct. on the capital outlay involved. The Council, however, have so far declined to give the guarantee.

In commemoration of his fifty years' association with the firm, Mr. J. H. Hicks, the tool department foreman at the Bryan Donkin Company's works, Chesterfield, has been presented with a silver flower bowl. The ceremony was performed by Alderman G. Clark (Managing-Director), and accompanying the gift was an illuminated memento containing the names of the subscribers. Mr. Hicks first became connected with the firm in 1871, when the headquarters were at Bermondsey; and he was one of those who went to Chesterfield upon the works being established in the town many years ago.

The Manchester Coroner returned a verdict of "Suicide during temporary insanity," at an inquest on Emily Jane Watkins, who was found dead at her home. Her head was resting on a pillow in the gas-stove; and the taps were turned on. Evidence was given that since undergoing an operation some time ago, Mrs. Watkins had complained of pains in her head.

The Birmingham General Purposes Committee have withdrawn a clause from the Corporation Bill to be submitted to Parliament which proposed to make individual owners responsible for the lighting of gas lamps in the courts and alleys. There are gas-lamps in the courts; but many are not lighted, as there is no power to enforce the owners of the property to do so. The Town Clerk pointed out that the Corporation had power to light the lamps; and in view of this power, given by a Special Act of Parliament, the Committee took the view that it would be inconsistent for them to seek to lay the burden on individual owners.

STOCK MARKET REPORT.

BUSINESS on the Stock Exchange last week was quieter, and the prevailing tone was dull for the most part. The state of public affairs did not tend to brighten markets, and money was decidedly tighter.

The gilt-edged division, however, did not suffer. Home Government issues were firm; the big four showing on Friday thus: Consols 48⅞-49¼, War Loan 87⅞ 88⅛, Funding 72⅝ 73¼. Victory 79⅜-79⅞. In the Foreign Market, movements were irregular; but Argentine, Chinese, and Brazilian closed steady. The Miscellaneous Market was not strong. Rubber and Oil were weaker on the whole, and Iron and Steel were depressed.

Business in the Gas Market was quite active. Gas Light and Imperial Continental being the foci of attention, and the tone was very firm. The London Companies were very steady at slight advances, and the Suburban and Provincial had another week of gains. These embraced Brentford, Hastings, Ilford, Newcastle, and Southampton. In the Continentals, Imperial had a remarkable career. The number of transactions recorded daily were probably unprecedented, and the prices rose from 135 to 150 on Friday. Malta and Primitiva preference also counted fractional improvements.

Bargains done for cash during the week were as follows: On Monday, Brentford "A" 70, ditto "B" 66⅛, 66¼, British 22¼, Buenos Aires 43¼, Commercial 3½ p.ct. 50¾, 51¼, Continental Union 18, European 6⅝, Gas Light ordinary 63½, 63⅝, 63¾, 64, 64⅛, 64¼, 64⅜, 64½, ditto preference 60¼, Imperial Continental 135, 136½, 137, Primitiva 13s., ditto preference 38s. 6d., 40s., River Plate 43, South Metropolitan 70¼, 70½, ditto 6½ p.ct. debenture 102¼, Wandsworth new 57⅜, Barnet "A" 112½, 113, Hampton Court 5 p.ct. 50¼, Monte Video 5 p.ct. mortgage 70. On Tuesday, Brentford "A" 70, Brighton and Hove original 117, Commercial 3½ p.ct. 51, Continental Union 18, ditto preference 30½, 31½, Gas Light ordinary 63½, 63⅝, 64, 64¼, 64⅜, 64⅛, ditto maximum 45, Hastings and St. Leonards 3½ p.ct. 35½, 35⅝, Imperial Continental 137½, Lea Bridge 72, Newcastle 59, 59½, Oriental 87½, Primitiva preference 38s. 6d., 39s. 9d., ditto debenture 66½, 66⅝, River Plate 43½, South Metropolitan 70, 70¼, 70½, ditto 7½ p.ct. debenture 102½, 103, Bournemouth 6 p.ct. debenture 101⅜, Richmond 5 p.ct. 50½, 51. On Wednesday, Aldershot preference 51, 51½, Alliance and Dublin 49⅜, 49⅝, Brentford "A" 70, ditto "B" 69, Brighton and Hove original 117⅜, British 22⅝, Commercial 4 p.ct. 56½, ditto 3½ p.ct. 51½, 52⅛, European 6⅝, Gas Light ordinary 64, 66, 66½, 66⅛, ditto maximum 44½, ditto preference 60¾, ditto debenture 51, Imperial Continental 137½, 138, 139, 139½, 140, 140½, 141, 141½, 142, 142⅛, 143, South Metropolitan 69½, 70, ditto 6½ p.ct. debenture 102½, 102⅛. On Thursday, Bournemouth "B" 71, British 23⅛, Commercial 3½ p.ct. 51½, 52, 52⅛, Gas Light ordinary 63½, 63⅝, 64, 64¼, 64⅜, 64½, ditto maximum 45, Imperial Continental 142, 142½, 142⅞, 143, 143½, 143⅝, Newcastle 62, Oriental 87½, South Metropolitan 69⅛, 69⅜, 70, 70⅜, 70½, ditto 6½ p.ct. debenture 102⅞, South Suburban debenture 74⅛, Southampton 56½, Wandsworth new 57½. On Friday, Alliance and Dublin 49¼, Commercial 3½ p.ct. 53, 53⅛, Gas Light ordinary 63¾, 64, 64½, 64⅝, 64⅛, ditto maximum 45, Imperial Continental 144, 144½, 145, 145½, 146, 146½, 147, 147⅛ 147⅜, 147½, 148, 149, 150, South Metropolitan 70½, ditto 6½ p.ct. debenture 103, Wandsworth new 57, 57½.

In the Money Market, there was a strong demand which intensified almost up to the close, when it eased somewhat. Discount sympathized. The Bank rate is 5 p.ct., as fixed on Nov. 3.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
182,049	Stk.	Aug. 26	4	4%	Aldershot 4 p.c. Pref.	...	50—55	51—51½
1,551,868	,,	Oct. 13	2½	3½%	Alliance & Dublin Ord.	39—64	48—51	49¼—49⅝
374,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	46—51	..
280,000	5	Aug. 11	7½	4/-	Bombay, Ltd.	5⅝—6⅛	3—3½	..
100,000	5	,,	16	4/7½	Bourne- { 5 p.c.	...	7⅜—8⅛	...
383,110	10	,,	7	7/-	mouth Gas { B 7 p.c.	15—15½	8½—9⅛	...
115,000	10	,,	6	6/-	and Water { Pref. 6 p.c.	13½—14	7⅛—8⅛	...
162,065	—	June 30	—	4%	{ 4 p.c. Deb.	...	54—59	...
992,045	Stk.	July 15	14	56/-	Brentford A Consolid.	261—266	68—71	70
734,980	,,	,,	11	55/-	Do. B New	204—209	67—72	66½—71
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	68—72	..
221,400	,,	June 13	4	4%	Do. 4 p.c. Deb.	91—93	57—59	...
214,775	,,	Aug. 26	11	10⅝%	Brighton & Hove Orig.	208—213	115—120	117—117½
144,200	,,	,,	8	7½%	Do. A Ord. Stk	154—159	82—87	..
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	...	...	..
530,000	20	Sept. 29	12½	10%	British	44—45	22—24	22½—23½
120,000	Stk	June 30	4	4%	Do. 4 p.c. Deb. Stk	88—90	55—58	..
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb	85—87	42—45	43½
100,000	10	May 27	—	6%	Cape Town & Dis., Ltd	1½—2½	6½—7½	..
100,000	10	Oct. 28	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5½	..
100,000	Stk.	June 30	4½	4½%	Do. 4½ p.c. Deb. Stk	70—75	53—58	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	..
1,513,280	,,	July 28	5/9/4	42/8	Commercial 4 p.c. Stk	106—108	54—57	56½
560,000	,,	,,	5½	38/4	Do. 3½ p.c. do	103—105	50—53	50½—53½
475,000	,,	June 15	5	5%	Do. 3 p.c. Deb. Stk	69½—71½	44—47	..
800,000	,,	Dec. 11	4	—	Continental Union Ltd	76—79	18—20	18
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	30—35	30½—31½
51,600	,,	Aug. 26	15	15%	Croydon A 10 p.c.	...	150—155	...
278,400	—	,,	12	12%	Croydon B and C 7 p.c	...	120—125	...
492,270	Stk.	—	6	4½%	Derby Con. Stk.	125—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 29	10	5/0	European, Ltd.	17½—18	6½—7	6⅝—6⅞
16,298,975	Stk.	Aug. 11	4/17/4	46/8	Gas { 4 p.c. Ord.	98—102	63—65	63⅜—66½
2,600,000	,,	,,	3½	35/-	Light { 3½ p.c. max.	76—79	44—46	44½—45
4,062,235	,,	,,	4	4%	and { 4 p.c. Con. Pref.	96—99	60—62	60½—60⅝
4,674,850	,,	June 15	3	3%	Coke { 3 p.c. Con. Deb.	72½—74½	50—52	51
130,000	,,	Dec. 11	10	10%	{ 10 p.c. Bonds.	...	...	...
82,500	,,	Sept. 14	5	3⅝%	Hastings & St. L. 5 p.c.	...	48—50	...
258,740	,,	,,	3½	2½%	Do. 3½ p.c.	37—39	38—40	35½—35⅝
70,000	10	May 12	11	5%	Hongkong & China, Ltd.	16½—16⅝	5—6	...
86,600	Stk.	Aug. 26	9	9½%	Hornsey 7 p.c.	...	100—105	...
131,000	,,	July 28	7½	7½%	Ilford A and C	151—154	84—86	...
65,780	,,	,,	6½	5⅞%	Do. B	115—118	61—63	...
65,500	,,	June 30	4	4%	Do. 4 p.c. Deb.	92—94	54—56	...
1,976,000	,,	Oct. 28	9	5%	Imperial Continental	150—160	145—150	135—150
1,255,000	,,	Aug. 11	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	83—85	...
253,242	,,	Mar. 30	6½	3½%	Lea Bridge Ord. 5 p.c.	119—121	71—73	72
2,498,903	,,	Feb. 26	10	57/6	Liverpool 5 p.c. Ord. { A	211—213	...	...
					{ B	146—148	...	...
306,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk	...	...	...
165,736	,,	Aug. 11	7/5/6	6%	Maidstone 5 p.c.	...	54—56	..
63,480	,,	Dec. 30	—	3%	Do. 3 p.c. Deb.	...	40—43	...
75,000	5	June 11	6	3%	Malta & Mediterranean	4½—4⅝	2—2½	...
250,000	100	Oct. 3	4½	4½%	Met. of { 4½ p.c. Deb.	99—101	88—96	...
541,920	Stk.	May 27	4	6%	Monte Video, Ltd.	11½—12	55—60	..
1,873,892	,,	July 28	4½	3%	Newcastle & Gatsh'dCon.	98½—99½	61—63	59—62
529,705	,,	June 30	3½	3½%	Do. 3½ p.c. Deb.	82—83	50—52	...
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	...	12⅜—13½	...
55,940	10	,,	7/14/-	5/3	,, ,, 7 p.c.	14—15	7⅛—8½	...
300,000	Stk.	May 12	8	8%	Oriental, Ltd.	117—122	85—90	87½
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅝	2—3	...
188,120	Stk.	June 30	—	3½%	Plym'th & Stonah'se 5 p.c.	...	64—67	...
60,000	50	Aug. 26	13	60/-	Portsea Island, B	128—131	64—67	...
100,000	50	,,	12	55/-	Do. C	118—121	51—54	...
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	⅛—¼	13/-
499,960	5	June 26	5	—	Do. 5 p.c. Pref.	4½—5	1⅛—2⅛	38/6—40/-
521,600	100	June 1	4	4%	Do. 4 p.c. Deb.	91—95	65—67	66½—66⅝
600,000	Stk.	July 28	4	4%	Do. ,, ,, 1911	...	42—45	...
346,198	,,	June 30	4	4%	River Plate 4 p.c. Deb.	85—87	42—45	43—43½
150,000	10	Sept. 29	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	6—6½	...
125,000	50	June 30	5	5%	{ 5 p.c. Deb.	47—49	35—38	...
135,000	Stk.	Aug. 26	10	5%	Sheffield A	223—224	61—62	...
209,984	,,	,,	10	5%	Do. B	223—224	62—64	...
523,500	,,	,,	10	4½%	Do. C	220—222	61—63	...
133,201	Stk.	Sept. 15	4	4%	Shrewsbury 5 p.c.	...	...	...
90,000	10	Oct. 28	9	8%	South African	10½—11½	7—9	...
6,609,895	Stk.	July 28	5/4/-	5%	South Met. Ord.	111—113	69—72	69½—70½
250,000	,,	July 14	—	5%	Do. Red. Pref.	...	93—95	...
1,895,445	,,	,,	5	5%	Do. 3 p.c. Deb.	72½—74½	48—50	...
224,820	,,	Feb. 25	3½	7½%	South Shields Con. Stk.	157—159	88—90	...
1,087,795	,,	Aug. 11	6	5½%	S'th Suburb'n Ord. 5 p.c.	114—116	68—70	...
368,837	,,	June 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	73—76	74½
647,740	,,	Nov. 16	7½	4%	Southampton Ord.	99—102	54—57*	56½
127,273	,,	June 30	4	4%	Do. 4 p.c. Deb. Stk.	...	59—61	...
120,000	,,	Aug. 11	—	6%	Wandsworth, Wimbledon, and Epsom—			
782,275	,,	,,	6	4½%	Tottenham { A 5 p.c.	135—138	63—65	...
181,255	,,	June 15	4	4%	District { B 3½ p.c.	115—117	53—55	...
182,380	10	Dec. 30	5	—	{ 4 p.c. Deb.	87—89	54—57	...
149,900	10	July 1	5	5%	Tuscan, Ltd.	5—6	1—2	...
236,476	Stk.	Aug. 26	5	1½%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
					Tynemouth 5 p.c. max.	108½—109	64—66	...
30,000	,,	Aug. 11	8½	66/3	Wandsworth, Wimbledon, and Epsom—			
855,636	,,	,,	6½	51/3	Wandsworth A 5 p.c.	151—156	78—80	...
108,075	,,	,,	—	46/4½	Do. B 3½ p.c.	129—134	59—61	...
140,865	,,	,,	—	46/4½	Do. C	...	56—58	...
552,000	,,	,,	6½	45/-	New Ordinary	...	57—59	57—57½
98,000	,,	,,	6½	50/-	Wimbledon 5 p.c.	117—122	53—55	...
88,416		June 30	1	3%	Epsom 5 p.c.	121—126	56—58	...
					5 p.c. Deb. Stk.	66—60	44—47	...

* Ex Div.

INDEX TO ADVERTISERS IN THIS WEEK'S "JOURNAL"

	PAGE
Anglo-American Oil Company, Ltd.	588
Arrol, Sir William, & Co., Ltd.	586
Ashmore, Benson, Pease, & Co., Ltd.	582
Bale and Church, Ltd.	578
Benn Bros., Ltd.	578
Berendsen, Sophus, & Co., Ltd.	539
Blakeley (Firth), Sons, & Co., Ltd.	578
Braddock, J. & J. Wrapper II., Centre VIII.,	578
British Aluminium Co., Ltd.	Wrapper I.
British Creosote Company	541
British Furnaces, Ltd.	540
British Gas Purifying Materials Company, Ltd.	579
British Mannesmann Tube Co., Ltd.	532
British Petroleum Company, Ltd.	538
Brotherton & Co., Ltd.	580
Brownhills Chemical Works Company	579
Burt, Boulton, & Haywood, Ltd. Wrapper	IV.
Carron Company	576
Chapman (Spencer) and Messel, Ltd.	579
Chemical Engineering and Wilton's Patent Furnace Company, Ltd.	588
Clapham Bros., Ltd.	590
Clark's Lead and Colour Works Co.	534
Clayton, Son, & Co., Ltd.	589
Constable, Hart, & Co., Ltd.	579
Cort, Robert, & Son, Ltd.	536
Cowan, W. & B.	Wrapper III.
Crossley Bros.	587
Curtis's and Harvey, Ltd.	531
Dempster, R. & J., Ltd.	575
Dempster, Robert, & Sons, Ltd.	528, Centre V., 580
Dixon (Joseph) Crucible Company	539
Dixon, Leslie, & Co.	580
Donkin Co., Ltd. (The Bryan).	Wrapper II.
Drakes, Limited	589
Duxbury, Thomas, & Co.	580
Evans, Joseph, & Sons	587
Falk, Stadelmann, & Co., Ltd.	585
Forth and Clyde and Sunnyside Iron Cos., Ltd.	539
Gas Distribution, Ltd.	539
Gas Meter Company, Ltd. (The)	Wrapper IV.
Gas Purification and Chemical Company, Ltd.	Wrapper I., 578
Glenboig Union Fire Clay Co., Ltd.	Wrapper II.
Glover, George, & Co., Ltd.	Wrapper I.
Glover, Thos., & Co., Ltd.	544
Grant, David, & Co.	581
Griffin, John J., & Sons, Ltd.	580
Griffiths Bros. & Co. (London), Ltd.	Wrapper I.
Hardman and Holden, Ltd.	534
Harris and Pearson	Wrapper IV.
Hawthorn Leslie & Co., Ltd.	Wrapper I.
Heathman's Ladder Factory	580
Hislop, R. & G.	585
Hodges, R. J., & Co.	530
Horstmann Gear Company, Ltd.	528
Humphreys and Glasgow, Ltd.	542
Hutchinson Bros., Ltd.	579
Jenkins, W. J., & Co., Ltd.	585
Keith (James) and Blackman Co., Ltd.	590
Kenyon, Alexander, & Co.	580
King's Patent Agency	578
Kirkham, Hulett, and Chandler, Ltd.	534
Laidlaw, R., & Son (Edin.), Ltd.	587
Lead Wool Co., Ltd.	Wrapper II.
Le Grand, Sutcliff, and Gell, Ltd.	585
Lord, J. E. C. (Manchester), Ltd.	579
Macfie, D.	579
Main, R. & A., Ltd.	537
McKelvie, James, & Co.	Wrapper I.
Messenger & Sons	534
Mewburn, Ellis, & Co.	579
Mitchell, H.	Wrapper I.
Moore's Gas Generator Synd., Ltd.	579
National Benzole Company, Ltd.	532
New Inverted Incandescent Gas Lamp Company, Ltd.	541
Orme, Geo., and Co.	530
Page, Charles, & Co., Ltd.	Centre VI.
Parkinson and W. & B. Cowan, Ltd.	583
Parkinson Stove Company, Ltd.	540
Parkinson, W., & Co.	544
Peckett & Sons, Ltd.	538
Peebles & Co., Ltd.	583
Pifco, Ltd.	582
Pocock, Herbert	543
Podmore and Co.	Centre VI.
Potterton, Thomas	Centre VII.
Radiation, Ltd.	Centre II., III.
Ramie Company, Ltd.	536
Riley, John, & Sons	579
Robbins, Wilfred, Ltd.	538
Rotary Meter Company, Ltd.	585
Salford Paint and Varnish Co., Ltd.	579
Shields and Ramsay, Ltd.	541
Silkstone Main Colliery Co.	580
Simon-Carves, Ltd.	527, Centre IV.
South Metropolitan Gas Company	588
Spencer, Chapman, and Messel, Ltd.	579
Spencer, Walter, & Sons	581
Stephenson, Andrew	578
Stewarts and Lloyds, Ltd.	Wrapper I.
Sugg, William, & Co., Ltd.	529
Sutherland, A. G., & Co., Ltd.	Centre VI.
Sutherland Meter Company, Ltd.	531
Taylor, Joseph (Saturators), Ltd.	579
Telephos, Ltd.	580
Thomas and Bishop, Ltd.	581
Thompson, John (Wolverhampton), Ltd.	580
Torbay Paint Company	Wrapper I.
Trotter, Haines, and Corbett, Ltd.	Wrapper I.
Tully Gas Plants, Ltd.	533, 579
Vertical Gas Retort Syndicate, Ltd.	Wrapper I.
Walker, C. & W.	579
Walker, Crosweller, & Co.	581
Waller, Geo., & Son, Ltd.	530
Waugh, Walter, & Co.	585
Welsbach Light Company, Ltd.	535
West's Gas Improvement Co., Ltd.	584
Willey & Co., Ltd.	Centre VII.
Wilson (George) Gas Meters, Ltd.	579
Woodall-Duckham Company	Centre I.
Wright, Alex., & Co., Ltd.	Centre VIII.
Contracts, Articles Wanted and for Sale, Situations Vacant and Wanted, &c.	579, 580

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON TUESDAY, to ensure insertion in the following day's issue.

Orders to Alter or Stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Monday.

UNDISPLAYED ADVERTISEMENTS: Situations Wanted, Six Lines and under (about 36 words) 3s.; each additional Line, 6d. Situations Vacant, Apparatus Wanted and for Sale, Contracts, Public Notices, &c., 9d. per Line—minimum, 4s. 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

		ONE YEAR.	HALF-YEAR.	QUARTER.
United Kingdom	Advance Rate:	35/-	18/-	10/-
	Credit Rate:	40/-	21/-	11/6
Abroad (In the Postal Union) Payable in Advance		40/-	22/6	12/6

In payment of subscriptions for "JOURNALS" sent abroad, Post Office Orders or Bankers' Drafts on London only are accepted.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON

FOR SALE OUTRIGHT, OR ON LOAN.

SPENT OXIDE

PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LTD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.2.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for Gas-Works.
ANDREW STEPHENSON, Gresham House, Old Broad Street, LONDON, E.C. "Volcanism, London."

MUTTON Cloth Wipers.—Better than Cotton Waste. CHEAPER than Rags. Samples and Prices on Application to SMITHFIELD TRADING COMPANY, 60, ST. JOHN STREET, E.C. 1, Contractors to Railway Companies, many Gas and Electrical Power Companies, Municipal Bodies, &c.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E. 1.

WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.

REPAIRS RECEIVE PROMPT ATTENTION.

Telephones: 815 Oldham, and 2412 Hop, London.

Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LIMB, LONDON."

HIGH-PRESSURE DISTRIBUTION.

COMPLETE Tables for Flow of Gas in Mains, at all Pressures from ½ inch to 100 lbs.
Many other useful PRESSURE TABLES.
See "DISTRIBUTION BY STEEL" (Woodall and Parkinson), SECOND EDITION 15s. 9d., Post Free, BENN BROS., LTD., 8, Bouverie Street, LONDON, E.C.4.

INVENTIONS PATENTED. TRADE MARKS REGISTERED.
Advice and Handbook free. 35 years' references. Gas Patents a Speciality. KING'S PATENT AGENCY, Ltd. (Director, B. T. King, A.I.M.E., British and U.S. Regd. Patent Agent), 146A, QUEEN VICTORIA STREET, LONDON, E.C. 4.

OXIDE OF IRON.
SPENT OXIDE BOUGHT.

BALE & CHURCH, LTD.
88, ST. MARY AT HILL, LONDON, E.C.3.
Phone: Minories 1484.

"TORTO" FIRE CEMENT.

BALE & CHURCH, LTD.
88, ST. MARY AT HILL, LONDON, E.C.3.
Phone: Minories 1484.

"KLEENOFF," THE COOKER CLEANSER.
Tins for Sale to Consumers.
In Bulk for Works Use.

BALE & CHURCH, LTD.
88, ST. MARY AT HILL, LONDON, E.C.3.
Phone: Minories 1484.

EXTENSIONS and Renewals. Ask us to quote before ordering GAS APPARATUS, COKE-OVEN PLANT, STRUCTURAL STEELWORK. Competitive prices, First Class Workmanship. Satisfaction Guaranteed.
FIRTH BLAKELEY, SONS, & CO., LTD., CHURCH FENTON, YORKSHIRE.